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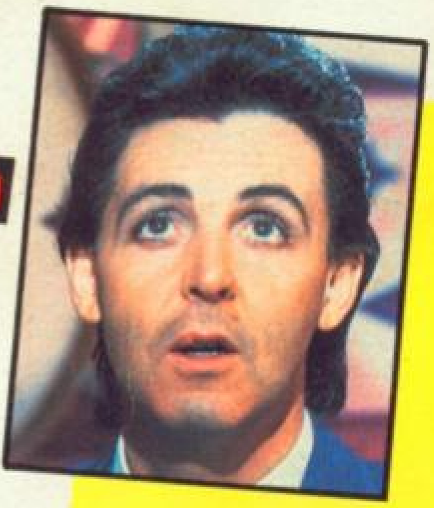
August/September 1985

ZX COMPUTING

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"An excellent and vast parody ... I would rather spend months unravelling 'Bored' than days on a self-important 'serious' epic ... Challenging and atmospherically written." (PCW) Huge, funny, beautifully graphical adventure spoof loads in 4 parts. No Stick. (Delta 4) **2 CASSETTES £5.95 M'DRIVE CARTS £8.95**

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CAULDRON

"There's an awful lot to this game and the graphics and action are superb, a compulsive, graphically tasty little number." (PCN) *"Superb pictorial game ... the graphics are brilliant and colourful ...* ***You will be getting two excellent games for the price of one.****"* (SUsr) The staggeringly beautiful Cauldron on one side of the tape and a FREE game 'The EVIL DEAD' on the flipside. Can't be beat. Sticks OK. (Palace) **DOUBLE CASSETTE £8.00**

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"Even without the strip feature, this game would still be very compulsive ... the scene where the girl removes her dress is very well done ... the movements are all natural and the effect is quite convincing." (AmUsr) Very well-animated game of 5-card draw poker with some of the biggest graphics you have ever seen. You can raise, stand, fold or bet but you cannot cheat. Mindy, modest Mindy, is your opponent. Be careful of her bluffing. Mind you, she doesn't always bluff... NO STICK. (Knightsoft) **CASSETTE £6.95**

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CONTENTS



ASP FIGHTS SOFTWARE PIRACY

Much has been said and written in condemnation of software piracy but few have taken a positive stand against it. ASP is among those few that have taken action to help curb the grave problem of home copying of commercial software.

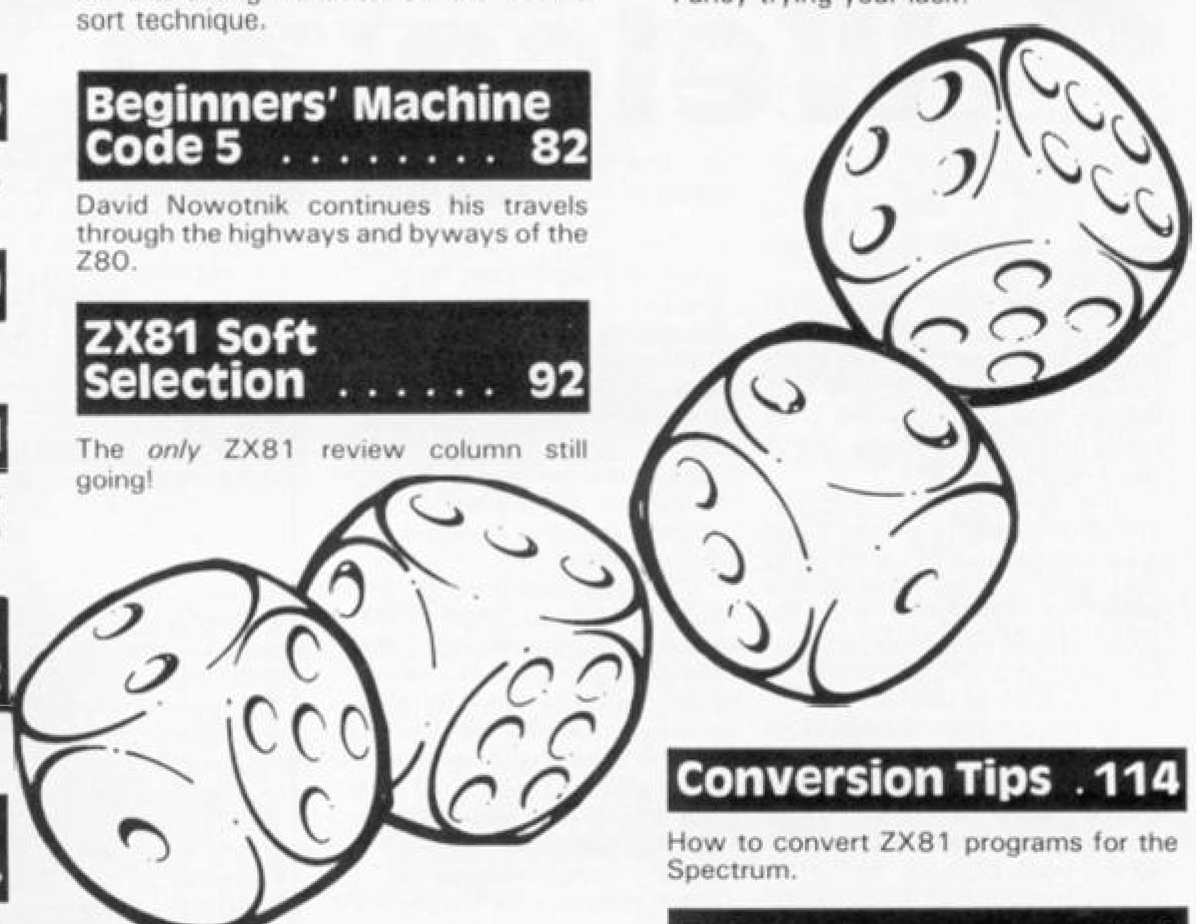
ASP has already taken steps to eliminate advertisements in our magazines which relate to tape duplication for piracy purposes. While it is appreciated that individuals may take 'back-up' copies of their own programs, it should be noted that it is *ILLEGAL* to copy commercially available software for other than personal use.

Software piracy is costing the software industry huge sums of money which is detrimental to the future development of the industry. It is in everybody's interests to dramatically reduce the level of software piracy primarily because firms need funds raised from software sales to plough back into research and development of new products. This means that the standard of software products can only improve.

ASP hopes our action will help combat this serious problem in order to maintain and improve the high standards of the UK software industry. We are asking *you* to do the same by refraining from duplicating or copying commercially available software for anything other than personal use.

MPUTING

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Welcome

I was looking through my collection of back issues of ZX Computing this morning when I realised that this issue is our third birthday!

Yes folks, three years ago in the summer of 1982 ZXC was born, none other than Tim Hartnell was acting father and Tina Boylan was acting mum. (I've never met her, she is now one of the Argus Legends).

The Spectrum was only just about to make its debut, there was no reference to it at all in the first issue, and all the programs were for the ZX80 and the ZX81. Toni Baker began a series on machine code programming, for the ZX81 of course.

All the program listings were done on a ZX printer except a few which had been type-set, there was a four page review/assessment of the ZX81 which cost £69.95 and a six page computing glossary which included pictures of a BBC, a Hewlett Packard and a Qume computer!

Some names of companies and people made me wish we ran a "where are they now" series:

Peter Furlong Products?
Video Software Ltd?
Second Foundation ZX81 Software?
Hilderbray/Holdco Ltd?
Andrew Developments?
Control Technology?
Crofton?
Kayde Electronic Systems?
Redditch Electronics?
Fuller?

But there are some who have survived and grown in stature:

DK'Tronics
Interface (which was, then, only the ZX users' club magazine)
Micro Gen (then spelt with a 'c')
Quicksilva
Hewson Consultants
Memotech

Before we move on to other things, greener grass and 1985, I would just like to quote from Tim's Welcome:

"At ZX Computing we're committed to producing a magazine which will be of genuine assistance to you to ensure you make the most out of your computer, whether you want it to help you develop your programming skills or learn machine code, play games or use it in business."

Three years on, this remains our aim.

That time of year

So, getting out my best handkerchief, tying the four corners into knots and positioning it carefully on my head, I deemed myself ready for the annual chaos known jokingly as our "holiday".

"Don't forget to take the cat to the cattery" remarked my spouse. Now I hadn't forgotten, I was just trying to avoid this particular task completely. If there is anyone who doubts there are mysterious forces at work in the world, then they don't own a cat. Ours is ALWAYS asleep on the best chair, that is except now. He is nowhere to be found.

"Didn't you keep him in?", the accusations fly thick and fast, yep, its holiday time again.

"'course I did, he must be here somewhere". Ten minutes of frantic family searching revealed his whereabouts.

"Well how did he get under the freezer?" The freezer had taken four men to carry it in (most claimed industrial injury in a high pitched voice afterwards, buying second hand professional catering equipment from auctions has its problems).

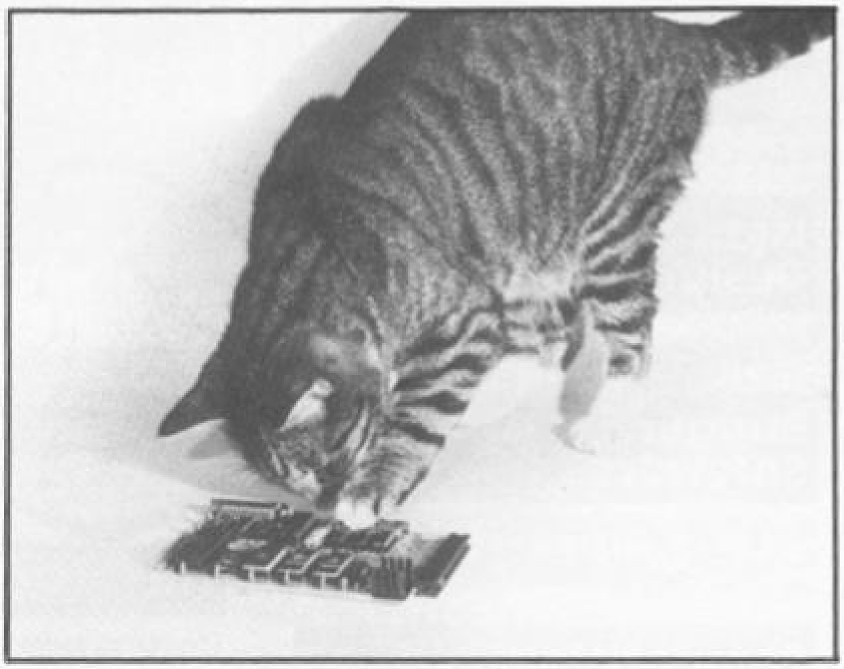
We all take turns going down on our knees and muttering "Puss, puss" in our friendliest, most persuasive voice. The cat, only his two eyes visible, gleaming from the depths, isn't fooled. He stays put.

Child no.1 gets a piece of cloth and ties the cat's favourite toy to it, a chewed rubber mouse, and pulls it around in front of the freezer. Moggie remains motionless. Drastic measures are called for, a tin of his favourite food is opened, the tin rattles, the odour wafted around in front of the freezer. The cat stays put.

Eventually we heave and strain till the freezer has been moved enough to reach behind it and grab the animal, he isn't giving up that easily. By the time he has been deposited in the cardboard box we are using for his short trip we all look as if we've been hunting tigers with pea shooters.

Leaving my wife administering liberal layers of TCP, I pick up the heaving box and, shouting goodbye over the hysterical wailing emmanating from the box, cart it to the car, dump it in the back, jump in the driver's seat and realise I left the ignition keys in the house.

By the time I get back, the cat, demonstrating all the ferocity of his ancestors, has bitten and clawed his way out of the box and is sitting calmly on the back seat. "Oh well", I think "he seems quiet now".



How wrong can you be? As soon as I had pulled out into the traffic the feckless feline begins to run around the confined interior of the car, this continued for a few minutes until he found safety and security sitting on my head. The rest of the drive was fairly peaceful although I kept getting odd looks from pedestrians and cars which overtook me (I was only going tc ten mph anyway in order not tc

provoke another fit of cat-panic).

It was when we arrived at the cattery I became convinced the beast was doing it all on purpose. As the warm liquid dripped down my neck I would have killed him if the cattery owners hadn't been waiting there full of kindness and goodwill to our poor dumb friends . . .

Up, up, and away

Well I really am going on holiday and I imagine many of you are too, I hope the weather is fine for us all and I hope you have as good a time as I hope I'm going to have! In the meanwhile take this issue along (or buy it where you go) just in case the day turns out cloudy, at least you'll have something to read.

Seikosha

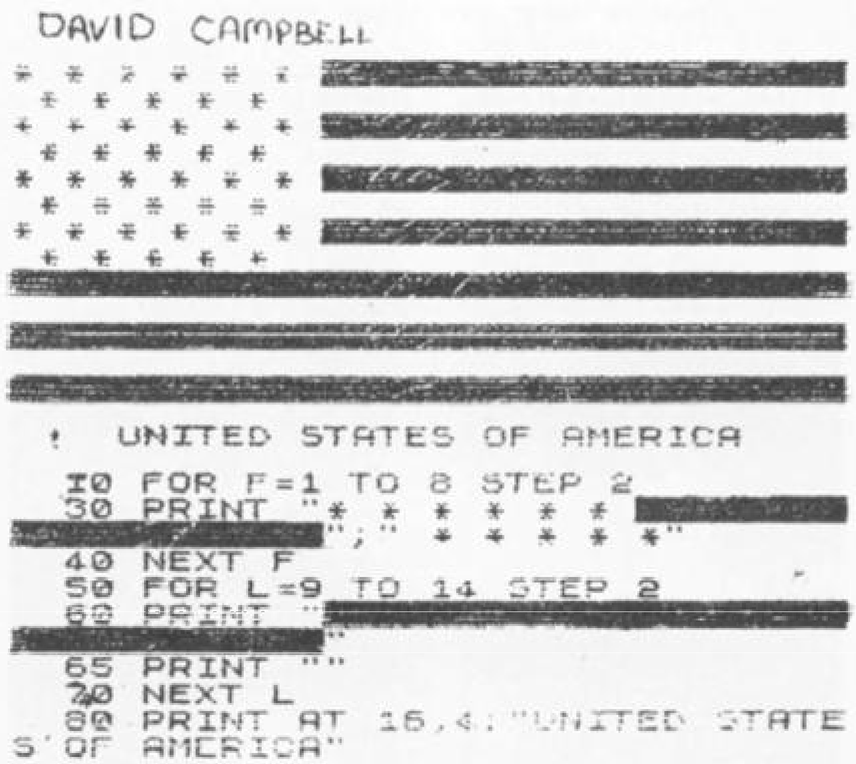
Dear ZX Computing,
Two weeks ago I bought a Seikosha GP-50S type printer for my 48K Spectrum. The problem was that the COPY command left out the bottom two lines of the screen. I had started to make a collection of the introductory screen pictures of my games, but unfortunately some of the games have screen pictures that use all 24 lines of the display (like Pedro, Penetrator, Kosmic Kanga) and this spoiled my collection. I tried the following to overcome this problem:

1) LOAD ""SCREEN$:PAUSE 0:COPY
2) POKE 23659,0:PAUSE 0:COPY:POKE 23659,2

Both were helpful in keeping the last two lines of the screen, but they did not work with the printer.

When I took a look at the COPY command routine (for this I used "The Complete Spectrum ROM Disassembly" by Dr. Ian Logan and Dr. Frank O'Hara) and realised that the routine didn't use the system variables. As a solution I wrote a short routine which changes the number of lines to be copied from 22 to 24. Thinking that it would be helpful for the readers who have the same problem, I have sent you the routine with an example which justifies what I mean.
Yours sincerely,
Turgut Aydin (Age 17)
Feneryolu S. 51/11
Kiziltoprak
Istanbul
Turkey
PS. Is there any way I can use my GP-50S with other micros such as the CBM-64 or the CPC-464?

Suggestions anyone? Meanwhile we're printing Turgut's COPY routine for anyone that's interested — Ed.



Why hex?

Dear Sirs,
Why do you publish listings in hex? I realise years ago hex was useful, even necessary. When you had nothing but blinking lights on a board you needed hex to combat binary. Today, no Sinclair computer accepts hex entries. Now everything is entered in decimal. Hex, like Latin, just serves to complicate the listings. I know the oldtimers were taught to program in hex, but today hex is nothing but a pain. This is especially true when it comes to machine code. People have given up communicating in Latin because it is no longer useful. Why not give up hex for the same reason? Now, there may be a flaw in this argument, but I will never see it unless you point it out to me. Please let me know if tapes are available of the programs you print. I do not really care for typing in listings.
Yours sincerely,
Ulyssese B. Adams
Philadelphia, USA.

We print hex listings because we're sent hex listings. Send us a listing in decimal, and, if it's any good we'll use it. There might be cassettes of ZX programs available in the future, we're looking into the practicalities involved — Ed.

L.I.S.T.

Dear Mr Elder,
I have been buying ZX Computing for only a year now and an quite pleased with your inclusion of Timex 2068 and hardware articles, of late.

Your U.S. readers should know that Spectrum emulation is practical in a number of ways, listed on the attached reprint from our newsletter. The least expensive method, by far, of achieving emulation, is that described by Paul McGinnis in your Feb/Mar issue. There are a few additional points which I can add to Mr. McGinnis' fine description. These are:

1) The cost of a Barclay check is $4.00. In figuring total cost, a U.S. buyer should include what he pays for the service.

2) VAT should not be paid. (However, on a recent split order to PV tubes, I paid £4 less for an order with straight postage and VAT than I did for one sent without VAT, but with a £7 handling charge).

3) The Modem port is a matter of contention, but 7C, 7D, 7E and 7F *or* C7, CF and D7, DF seem to be places to start. (NO Hardware!)

4) The 2068 joystick ports are at F5 and F6. The sound synthesizer at FE. TRY; OUT 254,7; OUT 254,23 for sound. SEND a 14 to F5 to activate the joyport. Then try reading F6.

5) Spectrum peripherals, by and large, will not work with the 2068 Buss, and can in fact destroy either the computer or peripheral or both. A "Twistor" is required to convert the 2068 buss to a Spectrum Buss. These are theoretically simple to make, but require tedious and precise assembly. Some peripherals do work, primarily because they use a partial, ZX81 compatible, bus. Two that I know of (and have) are the DK'Tronics light pen and Kempston joystick interfaces. Main power is not a problem — only the net DC voltages are important.

I hope these comments are of help. More specific information can be gleamed from the LIST newsletter.

Our user group prints a fairly large (22-24, photo-reduced pages) monthly newsletter, which in recent months, has described the twistor, emulators, a complete ROM cross reference (2068 to Spectrum) and how to use microdrives with the 2068. Membership in our group is $15/year and includes 12 issues of the newsletter. We also circulate a tape of member generated programs.

One last note, (which I hesitate to add, as I have not actually seen the product) is that there is a rumour of a "Clone" program which will translate Spectrum software into the proper 2068 ROM calls. How this is done, without extra memory, is difficult for us to fathom, but we will try to obtain the product, for review.
Very truly yours,
Paul Donnelly
Sec'y Treas.
LIST
Box 438
Centreport, N.Y.
USA.

Decimal places

Dear Sir,
Re: decimal places (problem page April/May Issue).
The answer to Mr Murfett's problem is quite simply:

LET x = INT ((10↑p) * n + .5) /(10↑p)

Where n is the number and p the number of decimal places, the .5 in the equation rounds up the last decimal number.

A simple demonstration program is:

```
10 INPUT "number to
   divide";x
20 INPUT "divide by ";d
30 LET n=x/d
40 PRINT n; "=divided
   number"
50 INPUT "decimal places re-
   quired ";p
60 LET x=INT ((10↑p) *
   n+.5)/(10↑p)
70 PRINT x; "=rounded up"
80 LET x=INT ((10↑p)/
   (10↑p)
90 PRINT x; "= not rounded
   up"
```

If you want to work to two decimal places only, a program could be:

```
10 INPUT "number to divide
   ";x
20 INPUT "divide by ";d
30 LET n=x/d
40 PRINT INT (100 *n+.5)
   /100
```

Therefore, multiply, then divide by one, plus a zero for each decimal place required. eg

10 for 1 decimal place
100 for 2 decimal places
1000 for 3 decimal places

I wonder if Mr Murfett or your readers will find this useful. It will also work on the ZX81.
Yours sincerely
J. Thorn
Swindon

Tall orders

Dear ZX Computing
I have seen many routines in magazines for printing double height characters on a ZX printer, with a ZX81. However, all these routines require a large amount of machine code to be entered. My routine however, is a short basic subroutine which produces double height characters in the next LPRINT command.

```
9000 FOR Z=16476 to 16483
9010 POKE Z,0
9020 NEXT Z
9030 POKE 16484,118
9040 RETURN
```

The program works by overwriting the 'NEWLINE' character at the end of the printer buffer with noughts. This stops the printer from slowing the paper advance and this causes the double height characters to appear.
Yours sincerely,
Alex Rogers
Radlett, Herts

Pen pals

Dear ZX Computing,
From the bottom of my heart, thanks. Since my letter was printed in the Dec/Jan '85 issue, asking for a pen pal, I have been amazed by what I got in reply.

One morning I was handed an airmail letter from South Africa. So, thanks again and keep up the good work (also thanks for the machine code series).

Yours praisingly,
J. Masters
9 Station Terrace
Allerton by Water
Castleford
W Yorks

PS. Could you please tell me how to store several screen images and then play them back in sequence so they appear to move?

That's not the sort of thing that can be dealt with in a simple answer, perhaps some of our other readers might be able to help you — Ed.

Ray and Cliff examine the latest Sinclair machine — the computerised Brillo pad.



Hot on the trail of a news story, the ZX team conduct a discreet enquiry into the rumours about the 128K Spectrum.



Hints

Dear Mr Turnbull,
Would you please publish some hints for the following adventures:

Sherlock — how do you enter Tricia Fender's house in Portman St, and Basil Phipps' house in Camden St? Also, any hints about the plot (I'm sure I'm not the only reader having problems with this one)?

Wrath of Magra — how do you get the Star Staff from the Wrath Lord on the second level of the mines in part 2, and how do you defeat the guardian at the entrance of Magra's fortress on the third level?

Finally, I would like to take this opportunity to praise The Quill, Gilsoft's adventure writing utility. It is simple to use, and really makes writing professional adventures possible for everybody, providing of course, that you have a good idea.
Yours sincerely,
Brendan Boll
Uetliberghalde 9
8045 Zurich,
Switzerland

I'm afraid that Greg Turnbull is no longer with us, though perhaps our new adventure columnist might start giving some hints and tips. In the meantime, is there anyone out there that can help Brendan with some tips? — Ed.

Same again

Dear ZX Computing,
I have discovered a useful effect when using the ZX printer on the ZX81. When using the LPRINT command it is possible to get double height printout by using two POKE commands. These are:

```
POKE 16476,0
POKE 16507,118
```

All you have to do is put these two commands before every LPRINT command that you want enlarged. It is only possible to print 32 characters at a time using this effect, because if the printer has to start a new line, the second line of the printout will be in the normal print. The two POKEs will cause the ZX81 to crash when any other BASIC or machine code program is used.

I am pleased to see that you are still printing material for the ZX81, when so many of the other magazines have left it behind. I wish that more software houses would follow the example of Software Farm and continue producing ZX81 software. If you consider that more than one million ZX81s were produced, many of which are still in use, then there must still be a market for ZX81 software.

So, whatever you do, please keep supporting us ZX81 owners.
Your faithfully,
G.M. Rainey
Wellington
Somerset

PS. I would like to see a regular adventure page, giving hints and tips on how to solve the many adventure programs for the ZX81 and Spectrum. Hints and tips could be provided by readers, enabling you to cover many different adventures.

Good idea, if anyone wants to write in with tips etc. then perhaps one of our columnists might take the hint. As for the ZX81, we're still supporting the ZX80, so '81 owners have got nothing to worry about — Ed.

Music and movement

Dear Editor,
One of the reasons for me buying a computer was to create music and animation. I have been taught the piano up to grade 6, and have tried several monophonic tunes such as Gershwin's 'Rhapsody In Blue' (*one of my favourites — Ed's assistant*). Just before Christmas I became the proud owner of a Newtech Trichord, giving me three channel sound on my Spectrum.

After programming such tunes as 'Fur Elise', A Whiter Shade of Pale' and 'The Baby Elephant Walk', I wrote off to Newtech on how to tune the Trichord to the musical scale (the data used in BASIC is the same as used in machine code).

After a couple of weeks they sent me a very nice reply, including a very useful formula:

fch/16/(tpc ✱ 256 + tpf = freq Hz

where tpc is the 'coarse tune registers' (0-15), tpf the 'fine tune register' (0-255), and fch the PSG clock frequency which is 1.589248 MHz on my particular machine.

Obviously this can vary from machine to machine by small amounts. I am sure this will be helpful to anyone else that owns a Trichord and is trying a different method of creating music than using the program supplied with the Trichord.

Do you know if there are any six or eight channel sound units for the Spectrum and are there any sound or speech units available for the QL?

Will you publish any readers' programs for the Trichord?
Yours sincerely
D.J. Shellhorn
C. Durham

We're always happy to look at readers' programs, of any sort. As for the sound units you mentioned, we don't know of any offhand, but that doesn't mean there aren't any. Suggestions anyone? — Ed.

System variables

Dear Ray,
I was flicking through the Spectrum manual when I saw the section on system variables. I found out that 23606 and 23607 control the characters used by the Spectrum.

I wrote this short program to move the 'chars' to address 25000, but I changed the order around so that the capital letters took the place of the small letters and vice versa. The letters used are the same width and height, but you can make them different by POKEing numbers from 25000 onwards to change their look.

```
1  PRINT AT 10,10:"Please
   wait"
2  REM letter reverser
5  LET a=25000:LET
   b=15616:LET 1=25263
6  GOSUB 20
10 LET a=25264:LET
   b=16136:LET 1=25775
13 GOSUB 20
14 LET a=25520:LET
   b=15880:LET 1=25775
15 GOSUB 20:GOTO 60
20 POKE a,PEEK b
30 IF A=L THEN RETURN
40 LET A=A+1:LET
   B=B+1
50 GOTO 20
60 POKE 23606,168:POKE
   23607,96
70 CLS:STOP
```

If you want to return to the normal ZX characters, type;

```
POKE 23606,0:POKE
23607,60
```

Yours sincerely
Matthew (aged 12)
Slough

Madness

Dear Sir,
The Meteor Madness game — written by Gavin Smyth is a masterpiece — however it does not allow you to terminate it when finished. This can be important when the game is part of a menu-driven program which resides on a microdrive cartridge and controls games, screens, programs etcetera.

Another key pressed (ie 'J' for load) has to be defined. This can be achieved: KEY 'j' pressed calls a routine which

a) reads the keyboard
b) calls, in the control program two ROM routines, ie: 1BB3 (LINE-END) and 1BBF (NEXT-LINE).

ad b.)

```
1 REM ✱ INITIAL PROGRAM
✱
2 CLEAR 30999
4 RANDOMIZE USR 31000
5               CLEAR:LOAD
✱"M";1;"run"
```

ad a.) 48K loader program: amend line 440, :"CDF47E00000000000 000" (disable val=check in 9000)

ADD LINES

```
1090 DATA "3EBFDBFEE601
1280A"
2000 DATA "3EBFDBFEE600
2003"
2010 DATA "20EEC9CDB31
BCDBF"
2020 DATA "1B000000"
```

SAVE the CODE with 1520 bytes and increase loopcount to 62527.

The Flight Simulation game annoys with its yellow border. If anybody wants to change the colour of the Border then:

```
POKE 51147,x
```

will make it possible, where x is the colour (0-1). Gave the amended CODE with 32768, 32000.
Yours faithfully
M. Capek
Victoria, Australia.

Switchboard

Sirs,
I was pleased to receive a copy of ZX Computing through a friend who recently returned from London. As you know there is an active interest here in Spectrumizing of the Timex TS2068 computer. In that light I would like to make the following product announcement for those who would like to maintain the 2068 mode . . . rather like having two computers in one box . . .

NORTH AMERICAN TS2068 USERS:
The Switchboard is now available. For those who have installed a Spectrum ROM in their TS2068 computers, the Switchboard allows the 2068 and Spectrum ROM to be switched without removal of the chips, by means of an externally accessable switch. Simple installation involves plugging in the Switchboard, installing both ROMs and the switch. This should be less than a 30 minute job for even the least mechanically adept of us. The Switchboard is available for $20 US, postpaid, with quantity pricing available. Payment by cheque or money order. Order from: J.L. Keene, 3515 Ingleside Drive, Dallas, Texas 75229.

I pass this on as it might interest your readers over here. I might note that there is a keen interest in British ZX publications here . . . so I have taken the liberty of passing on subscription information to the Dallas Times Sinclair Users Group . . . hopefully you will see a few subscriptions from that.

Thanking you for your attention.
Yours truly,
Jack L. Keene
Dallas
USA.

Shoptalk Shoptalk

Odds and ends, letters, and company info

It's For You Hoo . . .

Micronet is expanding, new services, new sections. The GALLERY is a new service which allows any member to produce his own displays of up to 26 frames for 24hrs, seven days a week.

The charge for this is a mere 25p per frame per six months, Mike Brown, the technical manager, said "Micronet members have already shown their artistic flair on chatline and this could be a means of expanding their creative resources. Gallery is all about taking part — it's an opportunity for members to have their own area of Micronet and show their work to everyone."

I am a member (though I haven't been on line for some time), and it's an interesting and often amusing way of passing a few hours, but I have not yet found any real practical use for it myself. Oh, and by the way, the subscription has gone up to £10.00 a quarter from £8.00. Still, it's the first since the service began in 1983, I only wish I could have a 25% rise!

DISKussion

Things are looking good for Opus, the company who recently launched the Discovery Disk drive (and who also recently moved to new premises at 55 Ormside Way, Holmethorpe Ind. Est. Redhill. Tel 0737 65080).

Amongst the praise in our review of their disk drive unit we also made one or two unkind remarks, and they hastened to write to us to explain.

Dear Ray,
I am given to understand that the disk drive supplied for review does not have the latest software on board and due to this it could well be that certain operations of the unit are not totally to your satisfaction. The current version of the software is 2:1 and this is available in a unit which we will replace the initial review unit with.

Our software writer has changed the positioning of the error pointer relative to the system stack pointer and this is now non-critical. This now enables certain machine code programs to operate. Also implemented is a user call which creates an artificial set of Microdrive variables for software which requires their presence. When RAM is fitted in the machine it will be possible to produce utilities which emulate certain of the hook codes and this utility software is being developed to support Discovery as a system.
Yours Sincerely,
Rowland Hoar.'



I'm not sure if I completely understood all that, but the replacement machine worked like a dream and I can only add that I am even more impressed now than I was with the first version. But it's still a tight fit between the back of the Spectrum and the front of the disk drive, especially if you have the cassette leads connected, and I still recommend using a ribbon cable or extender unit.

Speculation

It seems the usual, annual rumours about the next product from Sir C. are making the rounds. The last rumour about a cut down microdriveless QL to be sold at around £200 proved untrue and one wonders if the latest rumour about a 128K version of the Spectrum will turn out to be more substantial.

When we met some people from Sinclair Research recently they very carefully refused to confirm or deny the rumour — even if it's true they gain publicity from speculations such as these. Perhaps in the time that this mag is at the printers a more definite idea of what is happening will emerge. Meanwhile we're not holding our breath.

US Gold

We received a massive missive from this company in the form of an interview with Bill Stealey, president of US company Microprose who produced many of the US Gold strategy and simulation games. The article would have run to about four pages of what is essentially an advert and defence of their programs, and although interesting they were not at all specific about the machines which they would be featured on and so we decided not to produce any of it.

I'm sure that by saying that in Mr Stealey's opinion they produce the most harmless, realistic, accurate and best programs in the world, we have summed it up accurately, mind you, many of the US Gold programs *are* excellent.

Cheetah goes for the kill!

In the market for add-on devices Cheetah Marketing have produced a range of small, cheap but very useful extras to enhance your computing time.

A ribbon cable extension for the Spectrum's rear port is proced at £7.95 and is very useful for those using a non-standard keyboard (or perhaps an Opus Discovery Disk Drive!).

A pair of little plastic feet to stick onto the back of ZX81s and the old type Spectrum, to raise the typing angle to a better position (similar to the legs on the Spectrum+) will cost you £2.99 — but then interfaces hang off the back! No problem, get the ribbon cable mentioned above.

Fed up with connecting and disconnecting the TV to the computer and back to the aerial again? Cheetah's Two Way Aerial adaptor for £2.25 allows both to be plugged in at once and simply switched from one to the other as required. A sticky pad allows the adaptor to be stuck to the side of the TV.

Getting eyestrain from sitting too close to the TV due to the shortness of the computer/TV lead? For a mere £1.50 you can buy a 15 foot extension lead and really get away from all that harmful TV radiation. I know I've been a little jokey over these items but in truth they are very useful things and it is good that someone bothers to market them. A joystick interface was also recently released from Cheetah, this unit can be bought without a through port for £11.50 or with one for £12.75.

Their press release was a little sparse and we couldn't determine which protocol they used, we suspect it is Kempston but it may be Sinclair or Cursor. Check up at your local store and we'll try and get hold of one for review. An interesting product from the company that only a few months ago was claiming "the joystick is dead . . ."

People of note!

Lots of photos of people arrived for this issue, so we thought we'd let you have a look — you could start a scrapbook of your own 'rogues gallery' or at least when you phone up to complain you'll know what the person who is making excuses on the other end of the line looks like!



▲
Louise Smith has joined Kempston Micro Electronics Ltd. as sales and marketing executive and will be working with MD Ab Pandaal though from the looks on their faces, it seems that neither of them is very happy about the prospect!



▲
Peter Holme, Duncan Slark and Mike Leadbetter. Duncan is the eventual winner of the Observer Home Computer Championship 1985, was sponsored by Quicksilva and Sinclair Research. After playing a knock-out final and then designing his own game with the Games Designer program, Duncan was judged to be the winner and is pictured receiving two tickets to Florida and a silver trophy. Peter Holme, on the left, is marketing manager for Argus Press Software and Mike Leadbetter, on the right, is the Software manager for Sinclair Research — two more names and faces for the file.



▲
Eamon McGing and Steve Turner. This is a very handy photo for players of Hewson Consultants' Dragontorc because Steve is the author of the said program. Just cut out, pin to the wall and the next time you get stuck, throw darts at it. Eamon however will not be joining in this activity as he was presented with a citation for being the first person to complete the game, I've played it quite often have not managed to get out of the lost vaults of Locris!



▲
Director of Ocean, David Ward, is pictured suffering a bone crunching handshake from Konami's managing director, Kenji Hirasoka, as a demonstration of the action in a forthcoming Kung Fu program. But seriously, Ocean, who market many of the USA programs for the Spectrum, have signed a deal to market many of this Japanese company's programs. Look out for the release of Hypersports, Komani's Tennis, Yie Ar Kung Fu, Hyper Rally, Golf, Mike and Comic Bakery on the Imagine label ▶

Reset button and periperal extender

Unplugging the Spectrum's power lead to cure a program crash is about as sensible as switching off the National Grid to change a light bulb.

The Z80 processor is provided with a proper reset line which gently resets the system to zero. No power is lost to the computer or peripherals. So by using this facility there is less likelihood of damage to microdrive programs etc. Furthermore, programmable interfaces (joysticks etc) remain programmed so only the game or program needs to be reloaded — not the entire set up routine.

The Nidd Valley Reset and Extender offers such a reset facility in a neatly packaged, slim (14mm) connector casing. A small unobtrusive red button supplies the reset. The unit plugs into the user port and provides extension for other peripherals.

Its size is such that as an extender it makes up for the lack of space for fitting keyboards etc to the Spectrum, and enables add-ons to be fitted correctly into the very limited space provided on the Spectrum +.

The unit is priced at £4.95 including VAT and delivery, and is available from Nidd Valley Micro Products Ltd., Stepping Stones House, Thistle Hill, Knaresborough HG5 8JW.

Static matters

Considerable damage to computer programme material and even the equipment itself can be easily sustained with the build-up of static charges, almost unavoidable in many modern offices, business premises and private homes.

The AKG static eliminator mat will harmlessly discharge this dangerous potential preventing loss of data and stored information and, at the same time, ensure that no future changes accumulate (at least, that's what the press release says).

The mat, available in 2 sizes, 35 x 50cm and 46 x 61cm is simply located under the equipment with the snap-on earthing wire connected to any convenient earthing point such as a service pipe or trunking.

Manufactured in tough, hard-wearing conductive material and supplied complete with earthing wire and full user information, AKG static eliminator mat is available now at W.H. Smiths priced £11.99.



Three from Interface

Three books which are a little different from the norm have arrived from Interface Publications Ltd., 9/11 Kensington High St., London W8 5NP.

For the mercenary among us there is "Winning at the Races Using Your Computer" by Paul Worden, priced at £6.95. Many people have wondered about this possibility, including myself, and I once wrote a program which caused me to lose £5.00. However I gave this book a quick look and the author takes his subject and himself very seriously. One thing he doesn't do is present a program which will produce miraculous winners, but instead he discusses the factors which may influence a race and how to allow for them. The claim is that he has had a 20% profit rate but this is obviously less than he hopes t make by writing about it!

For the serious minded punter who owns a computer it could be valuable, for the dabbler it might be interesing, but the rest of us will probably stick to the pin method.

"Using Computers In Education" by Clive Gifford costs £5.25 and this book is an uneasy mix of how to, how not to, why, and why not to. Some of his ideas are a little optimistic — "if the students feel you are knowledgeable on the subject . . . they will respect you much more" — nowadays the students are likely to be much more knowledgeable than the teacher unless he has been trained or has studied the subject! Nevertheless, there is much interesting and useful information for teachers in this book. Most teachers omit or adapt what doesn't suit their teaching style anyway, and there are some interesting programs including a very impressive CESIL interpreter by David Hole. Useful reading for teachers.

Also useful for teachers is Tim Hartnell's book "Spectrum Logo" available at £2.99. This is essentially a listing of a program called Logo K in BASIC and a tutorial on how to use the Logo language. This is excellent if you have the time to type in the long programs, and the teaching section is written clearly and with effective examples. At this price it is worth buying to try out before deciding to spend nearly £40 on the (superb) Sinclair LOGO package.

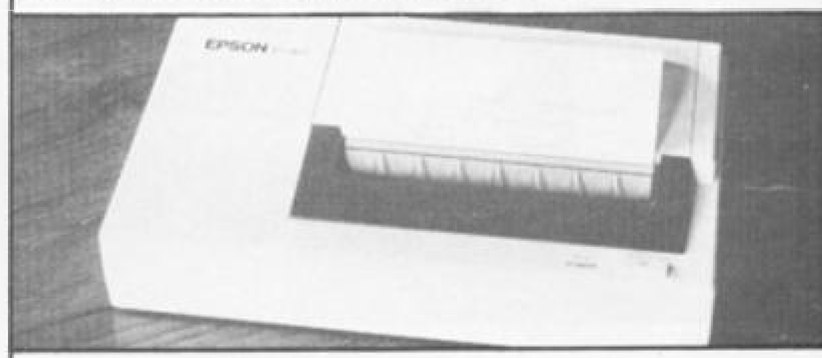
In . . . . Brief

• Kempston Electrical of Rushden in Northamptonshire have developed their own solution to the Static problem, put it in a spray can and called in Kemstat. They sent us a comparative pricing of £2.00 to spray 46 sq. yds and £1.20 for a similat mat. If you're having mysterious data loss and crashing programs then it may be worth looking at.

• Our first communication from Louise Smith, PR Kempston Micro Electronics Ltd (photo featured elsewhere), informs us of a disk drive interface to control 3, 3.5 and 5.25" drive units priced at £99.95. How many drives it will control, single or double density, single or double sided, how much RAM used was not stated, although we are told that it has its own OS on EPROM.

Send us one please Louise, so we can have a look at it?

• An interesting little printer from Epson came to our attention, priced at around £100 the P-40 is available with parallel or serial connections, prints 80 chars per line at 45 CPS. We'll try to get one to test ASAP. VSI Electronics Ltd., Roydonbury Ind Pk., Horsecroft Road, Harlow, Essex CM19 5BY.



• Evesham Micro Centre claim a breakthrough with the production of Interface III which should allow the transfer of all software to microdrive. It sounds very exciting and when we contacted them they promised to send us one for review but is has so far failed to arrive. Walltone Ltd., Unit 2 Crown Courtyard, Bridge St., Evesham, Worcs.

• OEL's demise caused a temporary set back to fans of communication networks, however the 4-Data Teletext/Telesoftware adaptor is now available from 4-TEL Teletext, 60 Charlotte St., London W1P 2AX. Write for order form and info. but do not send the £143.75 that it costs.

• Interesting unit advertised from Lawtronics Ltd., 139 High St., Edenbridge, Kent, TN8 5AX for around £45.00 It is an RGB monitor interface, now you can get the full quality of the Spectrum's display resolution on any commercial monitor. I have seen a specially adapted monitor operating on a Spectrum and it was most impressive.

Yet again we'll have a look at one and report back.

In .... Brief

• Longman have made a deal with American computer book publisher Sybex to distribute their wares over here. Which is good news, since the Sybex range includes Rodnay Zak's 'definitive' Programming The Z80. Meanwhile, they are bringing out Microelectronics A-Z which appears to be a guide to the wide variety and development of related language and terminology. Written by Malcolm Plant it costs £2.95 from, Longman Group Ltd, Longman House, Burnt Hill, Harlow, Essex CM20 2JE.

• Dictionary of Computing from Sphere Books Ltd, 30-32 Gray's Inn Road, London WC1X 8JL is prices at £4.95.
This is a specialist's dictionary which deals with terms of computing, maths, electronics and logic. General information is not included, for instance, Babbage is refered to only as a high level language and no reference to the person is made (you remember, Charles Babbage, who invented the Analytical Engine — oh yes, *that* Charles Babbage), it may be useful for the professional or student but perhaps a little specialised for the general user.

• For clubs, schools and groups, a useful publication is Computing In Print available from Cricket Hill, Yately, Nr Camberley, Surrey GU17 7PG for £2.95. This is around 140 pages of information on the books on computers and computing on the market divided into various sections such as computers, hardware, languages, business etc. It's invaluable for tracking down that half remembered book, and I've already found it useful in answering three readers' enquiries.

• CSP he produced a booklet which describes and explains how to use their "Padlock Nine" system which appears to need the presence of taped signals as a confirmation that the program is not a pirate copy. Priced at £9.95 from CSP Systems, 213 Stainbeck Rd., Leeds LS7 2LR it still left me thinking that a tape to tape copy wouldn't be protected. . .

• Biggest book of the month is The Century Programming Course for the Spectrum, edited by Prof. Peter Morse and Brian Hancock and Published by Century Publications Ltd., Portland House, 12-13 Greek St., London W1V 5LE (12.95), It's a comprehensive and serious book which should appeal to those who like their computing straightforward, without flashy or gimmicky pictures. A quick glance showed a variety of printer styles from the ZX printer to an Epson type, but if that's the worst that can be said of this book then it's a minor quibble. Worth taking the time to check up on.

• LISP is written by A.A. Berk(?) and published by Collins Professional and Technical Books, 8 Grafton St., London W1X 3LA for £9.95. Subtitled "The Language of Artificial Intelligence" this is a very detailed analysis of this language in relation to artificial intelligence and is probably the definitive work on the subject at the moment.

• Inside The Sinclair QL is a gentle introduction to the intricacies of the hardware and system design of the machine. Written by Jeff Naylor and Diane Rogers, published by Sunshine and priced at £6.95. Great for the non-experts with a little experience of Basic who want to move on from using commercial software to using the power of the QL for themselves.

• Another QL book from experienced authors Susan Curan and Ray Curnow (published by Papermac, 4 Little Essex St., London WC2R 3LF), Maximise Your QL £8.95 is perhaps a little more general, some 100 pages on using the programs supplied with the machine, approx 70 more on Superbasic and graphics, a bit on files, a chapter of 12 pages called "QDOS in Depth" (!).
A wide range of information which should contain something for everyone.

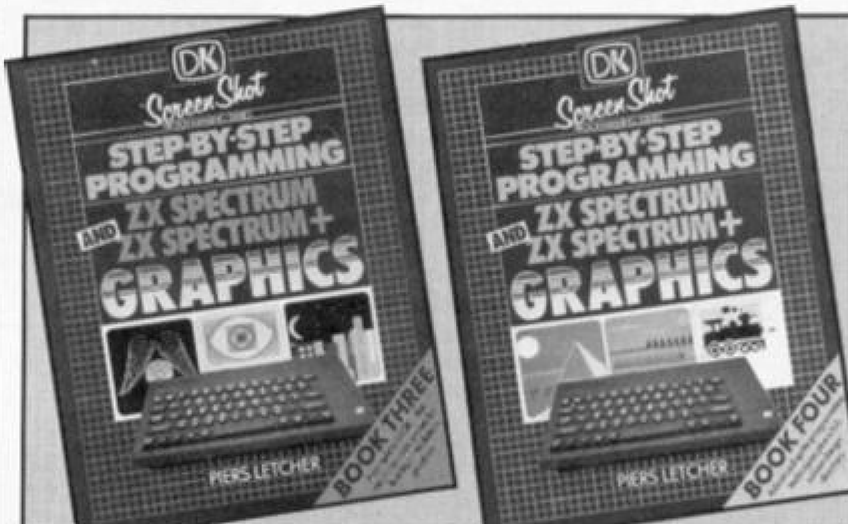
Learning made easy

Dorling Kindersley Ltd always add to my confusion by using their initials in their book titles and this causes me to make a totally irrelevant connection with another company using DK'.

Right, pointless comments aside, this company produces the most attractive "programming in easy stages" books on the market — they produced the Spectrum+ manual — and books with the longest titles. The two new books in the series dealing with the Spectrum are "Step-by-Step Programming, ZX Spectrum and ZX Spectrum+ Graphics, Book Three & Four". I haven't seen these particular titles, but if they're as good as the previous books in the series then they are well worth buying at £5.95 each.

DK also run the Goldstar software house which has produced a lot of good programs — including, for the reader who wrote in enquiring about one, a Typing Tutor program. When I answered his letter I did not know of any such Spectrum program but now DK plan to produce a screen shot "Starter Pack" which will include books 1 & 2 and a version of their Tiny Touch 'n' Go typing tutor for £15.95.

Dorling Kindersley can be contacted at 2 Henrietta St., Convent Garden, London WC2E 8PS.



QL Quick Disks

Ian Donaldson, marketing manager of Microperipherals, tells us that their new QL disk drive and interfaces are selling so well that their orders are now outstripping demand. So, if you're thinking of adding a few disks to your QL, why not give them a ring on 0256-473232.

QL International

Despite the QL's slow first year in Britain, Sinclair Research are pushing ahead with a number of overseas launches and foreign language versions of the QL.

France and Spain have already had the QL unleashed upon them, and the June/July period should have seen its launch into Italy, Denmark and Germany. Turkey, Greece, Holland, Portugal, Norway, Sweden and Finland should all get the QL towards the end of this year, while an arabic version is due for early 1985.

Commenting on the as yet unscheduled US launch, a Sinclair spokesman told us that the initial response to the QL, through a mailing with American Express, had been 'very positive'.

The QL, when launched, should sell for $499, and hopefully, now that the microdrives seem to have gotten their early reliability problems sorted out, the QL will be greeted in America as an example of 'quaint British innovation', since Sir Clive is already well-known in the states as a 'quaint British innovator'!

Kempston QL Add-ons

First is a Q.L. Centronics Interface which fits into a ROM cartridge slot. This interface is designed to drive any standard centronics printer, e.g. Epson, Seikosha, it also has the facility to do high resolution screen copies. There are already centronics interfaces on the market that plug into the serial port of the Q.L. but as this one plugs into the ROM cartridge port it leaves the two serial ports free. ▶

A buffer area contained within the interfaces means that the information being transferred from the Q.L. to the printer is not slowed down as it is being printed. The retail price, including the cable, will be £39.95 including VAT.

Secondly is a Q.L. disc interface. This plugs into the expansion port on the Q.L. and again works with any standard disc drive. The operating system for this interface is compatible with QDOS, and was written by Tony Tebby, who wrote for Sinclair Research. This new interface will also include extra tool kit commands. The retail price will be £129.95 including VAT.

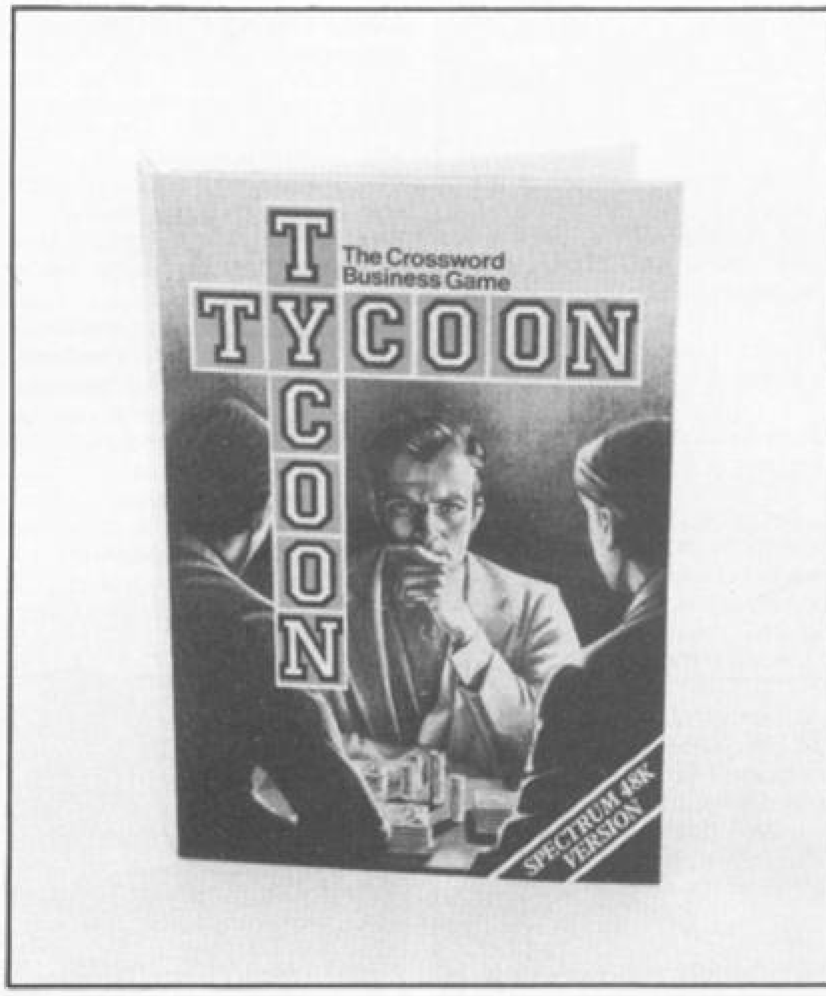
QL Means Business

Cash Trader, which runs on the Sinclair QL microcomputer, is written by Accounting Software (part of Quest International) and is available from QL stockists or direct from Sinclair at an RRP of £69.95 inc VAT.

QL Cash Trader requires no accountancy skill to operate and clearly explains all new concepts as they arise. Accompanied by a well-designed 222-page manual, it offers a wealth of practical examples, such as how to enter daily cash sales, or the modelling of financial decisions on the relative costs of buying or hiring office equipment. The program uses the QL's graphics capability to present information in a clear, easily understood form. QL Cash Trader comes on three separate Microdrive cartridges; QL Cash Trader; QL CT Boot and QL CT Report. A spare blank cartridge for data is also provided.

Money Talks

Sir Clive is a Mensa man (the group of top brains) and now Victor Serebriakoff, their International Chairman, has joined the computist ranks. Just over 18 months ago he began writing programs and now he has produced a commercial program.



TYCOON is an interesting mix of trading and crossword game programs in that players buy random or specific letters until they are able to guess a word. Each player starts with £1000 and has to buy, sell, invest and borrow. Gain £10,000 or more and you win, lose £10,000 and you are declared bankrupt.

There are 49 different crosswords and it is estimated that it would take some 80 hours to play them all once, not counting the variations. Available from Duckworth at £9.95 on cassette, £15.95 for Spectrum Microdrive cartridge (£6.00 difference for a £2.00 cartridge!) and £19.95 for the QL.

Oh and by the way, there's hope for our older readers as Mr Serebriakoff is no whizz kid, he's 72!



Wargaming

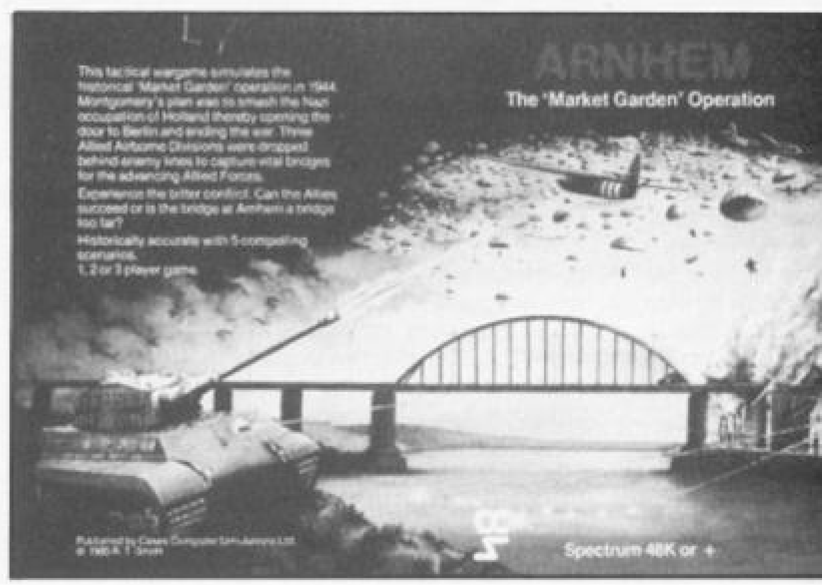
Computerised wargaming has improved in leaps and bounds from the early attempts, which were often little more than multiple choices and random results, to some very sophisticated programs indeed. I am looking at two games together, because although the scenarios and games are different, they have many features in common.

The two programs are THE BULGE from Argus Press Software at £9.99 and ARNHEM from Cases Computer Simulations at £8.95. Both programs are supplied in large presentation cases and have well produced, detailed instruction booklets.

ARNHEM recreates the "market garden" operation in reasonably accurate detail providing a choice of five variations on the game, from a short part of the whole operation, lasting about an hour, to the complete battle which can last up to ten hours!

Up to four players can take part and the game is played in turns during which all actions are decided upon and entered by the players. The graphics are good and this is very close to the traditional style of wargaming.

THE BULGE was programmed by Lothiorien and can be played by one or two players.



There are options to decide which army you command and the win conditions of the game. Unlike Arnhem this game is played in real time, rather like Stonkers (remember that one?) and orders are given via a cursor which can be controlled by joystick. Purists may argue that this introduces an arcade element but I find it hard to see how real time can be simulated unless such a simplified control is effected.

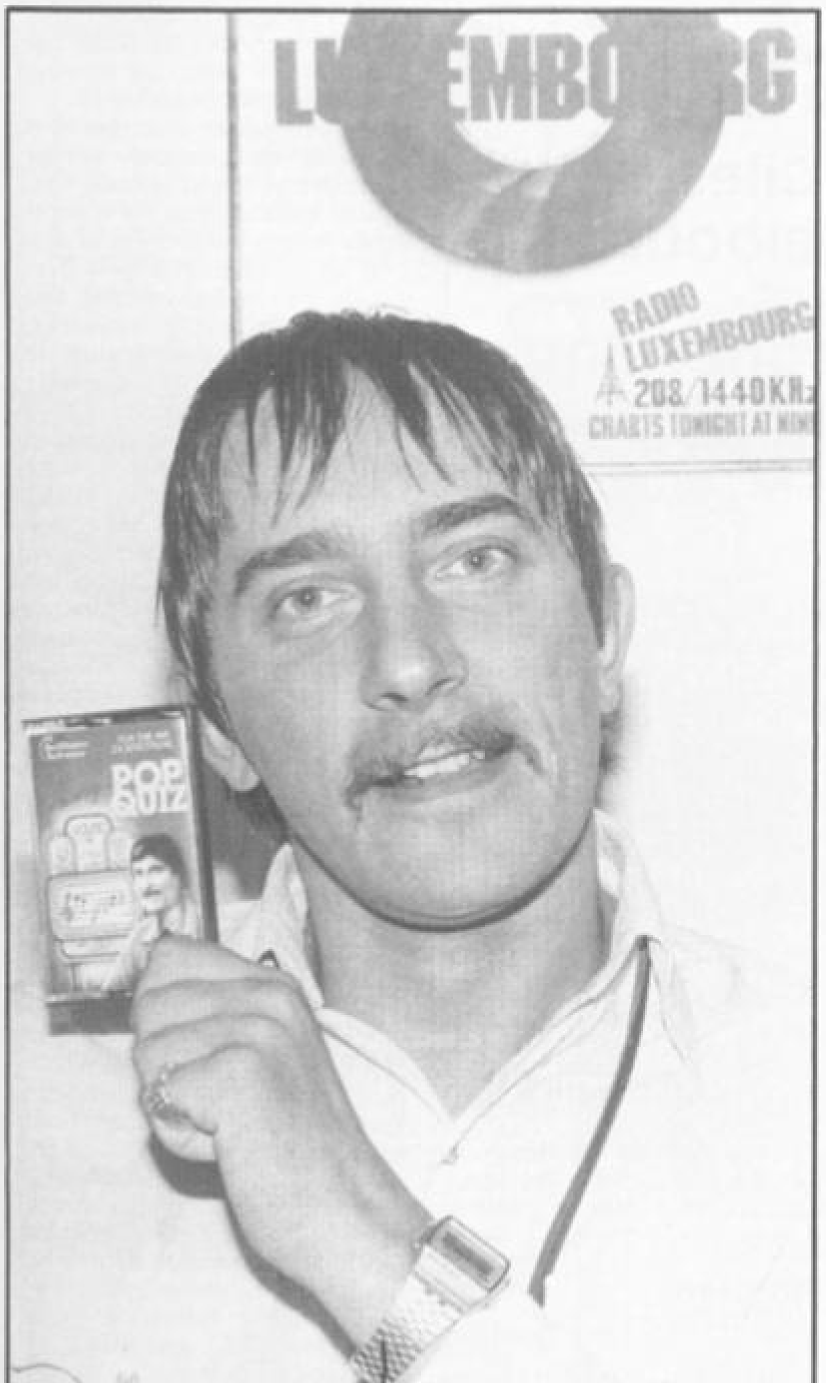
Simple the control may be but the game is fiendishly hard! Just as I organised one set of tactics to fight a battle, a message told me my troops in another zone were in trouble. I

found myself rushing around like a blue ✱✱✱✱d fly. And I lost. Whichever format you prefer, both these games are excellent and are the best of the genre that I have seen so far for the Spectrum.

Pop Quiz Update

A new, up to date version of the popular quiz program for the Sinclair Spectrum, *Stuart Henry's Pop Quiz*, is now available on Micronet 800. The questions in the quiz now include many teasers about the chart records of the past year, and the program has been modified to make it fully compatible with the new Spectrum+.

Sales of the program have already raised more than £2,000 for Multiple Sclerosis research, and a contribution will be made for every copy sold through Micronet



In .... Brief

• Kilsoft (32 Briarlyn Avenue, Birchencliffe, Huddersfield), are a small private company specialising in Educational programs and run an Educational club complete with a newsletter/magazine which is worth having. The Club costs £4.00 a year to join and the programs available cover a wide range of topics, mostly at CSE/O level revision level. We hope to get Mike Edmunds to look at some soon.

• Kempston hope to have CHICANE out by now, it sounds like an interesting motor racing game with gear changing and many realistic features. The game is programmed by Cambridge based Orpheus Ltd and produced in their new Data duplication plant (not many people know that!). We'll keep our eyes open for the review copy.

• JACK IN MAGICLAND is a pleasing Educational program from Turtle Software, "Wychwood", 40 School Rd. Finstock, Oxford, OX7 3DJ at £5.95. It is an adventure game but is supplied with a charming book of location pictures featuring a very spotty Jack, and a leaflet with the solution and some project/activity ideas for the parent or teacher.

• Griffin Software have produced a range of Revision software for Maths. English, Algebra, Trig. Formulae and Pythagoras' theorem. No more info sent, we'll try to get hold of some for Mike Edmunds to look at.

• Fawkes Computing who seem to be making ZX81 software profitable, have told us that due to the popularity of "Trojan Dragon" on their £5.95 Gamestape they are now selling it separately for £3.95. Pengy, an arcade game also for the ZX81 is their latest release and it costs £3.95. Note their new address at 14 Paddock Gardens, Alveston, Bristol, BS12 2LF.

• Scisoft's latest program hopes to take advantage of the imminent appearance of Halley's Comet. Astronomy is £6.95 and judging by their previous work is probably an accurate and comprehensive package, certainly worth checking on. Scisoft Ltd. 5 Minster Gardens, Newthorpe, Eastwood, Nottingham, NG16 2AT.

• A wide range of Utility programs is available from SD Micro Systems. PO Box 24, Hitchin Herts. SG4 0AE. Filing, Budgeting, Graphs, Stock and Mailing are just a few of their programs. Drop them a line for a full list and enquire about any particular application with which they may be able to help.

• The first officially backed program that I know of is Aasvoguelle Productions' "Mount Challenge", written by one Bill Percy who managed to get support from the Manpower Services "Enterprise Scheme". The game is quoted as being a 100% machine code, 89 screen arcade game priced at £6.95.

Presumably his financing didn't run to review copies so we can't say anything else except that if you wish to try it out they are at Blakemoor, Marshbrook, Church Stretten, Shropshire, SY6 6QA.

• Impact Software sent us a copy of Pete 'n Barry which didn't load (preproduction copy) then replaced it with another copy guaranteed to load — it didn't. This too was not the final product so we'll give them the benefit of the doubt and just mention that this arcade game is available from them at 2 New St. Cullompton, Devon, EX15 1HA for £4.95.

• Letaset from Eclipse Software will cost you £4.95 and provide a variety of 18 different character sets for use in your own programs, a great idea if you are an avid programmer and want to enhance your programs. Eclipse great; 79 Ardrossan Gardens, Worchester Park, Surrey, ET4 7AX.

• Parents and Teachers looking for Educational software may find it useful to contact FIVE TO TWELVE, 2 Church St. Seaford, East Sussex, BN25 1HD for their interest lies.

• PSS have converted "Battle for Midway" for the Spectrum and are asking £9.95 for it (whatever happened to Swords and Sorcery?). 452 Stoney Stanton Rd. Coventry, CV6 5DG.

• Statesoft have re-launched Bristles at the lower price of £5.95, a hectic mix of platform and painting games. I liked it and whiled away many a happy hour on this one.

Icicle Works was their last one but unfortunately the pre-production tape refused to load. Still, it should be worth seeking out at your local shop and giving it a whirl! £6.95 ■

On-Line with Micronet and Prestel

by Alan Giles, author of Melbourne House's Spectrum Micronet Book.

Now that the holiday season is upon us, Prestel really comes into its own as THE major travel information database — travel information is indexed from Prestel page 747. Much of the information is freely available to ordinary Micronet members, though some of the data is in 'closed user groups' and for use only by travel agents. You may also find information which is open to access by anyone, but is primarily intended for use by travel agents and so is slightly hidden, like the Sealink ferry availability information which starts on page 54504. If you root around these pages you will find full information on which ferry sailings still have space for your size of vehicle, and which sailings carry which fares — sometimes it can pay you to cross the channel in the middle of the night or the middle of the week, and these pages make it clear exactly which sailings these cheaper fares apply to. Other ferry operators run similar information services, sometimes accessed by keying hash (ENTER) from the normal information page for the matching sailing.

Airlines, tour operators, hotels, British Rail, overseas tourist boards, the English, Welsh and Scottish Tourist Boards and British Tourist Authority all have plenty of pages, so there's sure to be something to suit you. Get out your Prestel directory to help you find the right page to start on, and start looking around.

If you are looking for a last minute holiday, the pages of Standby (page 321) and BP Travel (page 290) may well have what you are looking for, with adverts from small and large tour operators arranged by date and destination.

If you are connected with a school that uses Spectrums rather than BBC micros, it might be worth telling them about The Times Network for Schools (TTNS). This educationally orientated information and message system uses Telecom Gold/ITT Dialcom technology but on the Times' own computer. It allows schools to communicate with each other and their education authority and swap notes about education or computers, or even swap programs. It also gives access to the processing power of the PRIME computer used by the system.

The VTX5000 Micronet adaptor has a devious little mode switch on its frontpanel which most people hardly ever



use, however it enables the VTX5000 to transmit data at 1200 bits per second, sixteen times the normal rate of transmission in M/NET mode. This allows you to communicate with another VTX5000 or similar device for another micro, sending programs or data. You can get "user to user" software which simplifies the use of this facility, but if you do not have a copy of this, or you want to do something more complicated than it allows, it is possible to drive the 8251 communications chip in the VTX5000 directly in machine code.

With the switch on the front of the VTX5000 in the TX position, the code

```
LD A,31H
OUT (FFH),A
```

sets up the adaptor to transmit bytes, each of which can be sent by a routine such as;

```
WAIT_TX IN A,(FFH)
        RLA
        JR NC,WAIT_TX
        LD A,data_byte
        OUT (7FH),A
```

It is possible to do the electronic equivalent of moving the front-panel switch to the RX position by using the code

```
LD A,36H
OUT (FFH),A
```

The transmitting and receiving stations obviously need to agree on what sequence of bytes will trigger the transmitter to turn itself into the receiver and vice versa. As it takes time to turn the electronics round and stabilise the line signals again, the new transmitter should wait a short while before sending any data, to allow the receiver time to get ready. The receiver can receive bytes of data with a routine such as:

```
WAIT_RX IN A,(FFH)
        BIT 7,A
        JR Z,line_break
        LD B,A
        AND 78H
        JR NZ,line_error
        BIT 1,B
        JR Z,WAIT_RX
        IN A,(7FH)
        AND 7FH
```

This ends with a received byte in the A register, if you are using the normal 7-bit, even-parity transmission mode you need the AND 7FH to remove the parity bit. If you choose the 8-bit, no-parity mode described shortly, this line should be removed.

A line_break indicates that there is no transmit carrier (whistle) on the telephone line, this is quite normal for a short while during the process of setting up or when changing over which end is transmitting and which is receiving. However, once data transmission is established the carrier should always be present, and line_break indicates problems with the telephone line.

A line_error indicates that received data has been lost either because your program was not reading the 8251 often enough to remove a byte before the next arrived, or because noise on the telephone line has corrupted the data. After such an error you must repeat the LD A,36H; OUT (FFH),A to reset the 8251 (otherwise it will continue to indicate that an error has occurred) and bear in mind that at least one byte has been lost, so when the transmitting VTX5000 invites you to transmit you must be able to request retransmission.

When the VTX5000 is switched on it sets itself up in a '7-bit even-parity' mode, which is the mode normally used on Prestel/Micronet, Telecom Gold etc. For Bulletin Boards and for user-to-user transmission you may find '8-bit no-parity' mode more useful, as it allows all eight bits in the trasmitted data to be used to carry meaningful information. The following code resets the 8251 and sets 8-bit no-parity mode

```
LD A,40H
OUT (FFH),A
LD A,6FH
OUT (FFH),A
```

With the help of an assembler you should be able to combine the various machine code snippets together to send and receive whatever data you like between a pair of VTX5000s.

Happy Communicating!


PERIPHERAL POWER
CASSETTE/DATA RECORDER
For your home computer, will allow easy loading of even the most stubborn program. Features include single key record, mains/battery, accepts standard computer leads and 5 pin DIN connector. Also provides exceptional audio quality for fine listening.
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Simply plugs into the user port at the rear of the computer and accepts any Atari style joystick including Quickshot and Kempston. Comes without rear edge connector at £11.50
or with connector which allows other peripherals to be stacked up at £12.75
56 WAY EXTENSION CONNECTOR
Cheetah's 6" long extension cable enables Spectrum peripherals to be distanced from your computer £7.95
32K RAMPACK
Upgrade your 16K ZX Spectrum now! The Cheetah 32K Rampack simply plugs into the user port at the rear of your computer and increases the memory instantly to 48K £39.95
AERIAL SPLITTER
Cheetah's neat splitter unit complete with self adhesive pad allows you to keep your T.V. and computer aerial leads plugged in without disturbing the picture £2.25
R.A.T.
Conventional joysticks are dead! The Cheetah Remote Action Transmitter is the most sophisticated computer controller available! Infra red transmission - so there are no leads trailing across the living room. Touch control, extremely fast, can be used with Cheetah RAT/Kempston compatible software. Complete with receiver/interface. £29.95
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These instantly applied stick on feet for your ZX 81, Spectrum, New Brain, VIC, TRS etc. tilt the computer and make your keys easier to see and more enjoyable to use, allowing smoother programming. £2.99
EXTRA LONG AERIAL LEAD
Over 15' long. Our super lead will allow you to sit back away from your T.V. and enable you to play games in the comfort of your armchair. £1.50
All Cheetah Peripherals have rear edge connectors for compatibility with all Sinclair accessories.
Prices include VAT, postage & packing.
Delivery normally 14 days.
Export orders at no extra cost.
Dealer enquiries welcome.
Cheetah, products available from branches of
John Menzies Boots WHSMITH Rumbelows
WOOLWORTH Spectrum dealers
and all good computer stores.
Cheetah Marketing
Cheetah Marketing Ltd. 24 Ray Street
London EC1R 3DJ Tel 01 833 4909
Telex 8954958

QUICKSOFT

Clive Smith looks at some slightly unusual software

DISCO SCREEN
Ash Products, £7.95 (M/Drive £9.95)

In my quest to find new and unusual programs, I came across this one. It's called Disco Screen, and is used to convert music from your stereo into flashing patterns on your TV.

The program auto runs on loading and all you have to do is replace the tape in the cassette player with an audio one. There is a choice of two modes, press 'D' for disco and the Spectrum's PAPER flashes as well as producing lines, block patterns and spirographs. Press 'R' for relax mode and you get the same type of patterns but the paper stays black.

This would be an ideal program to use if you run a disco with a video projector. The screen freezes when the music stops and could be used from a headphone socket. The effect was better than I thought it would be and speaking as an ex-DJ I would be more than happy to use it.

Now the bad news. It has bugs. I played one side of 'Thriller' through it and twice it stopped, with an 'Integer out of range' message. It tells you in the brief instructions to use RAND USR 40000 to re-start it, but I could get it to start by pressing CONTINUE and ENTER.

You can buy this program on either tape or microdrive (the tape takes 3 min 10 secs to load).

KNOW YOUR OWN PERSONALITY
Mirrorsoft
£9.95

If you are one of those people who are into 'self analysis' then here's something just for you. It's the usual 'question and answer' thing you find inside magazines occasionally. You have to add up your score at the end and then you are told something you already knew in the first place.

There are three sets of questions to answer, each set having 70 questions. The first is labelled 'Extroversion/Introversion' the next, 'Emotional Stability' and the last is 'Tough/Tender-mindedness'. There is a small booklist to assist you with introductory notes from Professor Hans Eysenck and Doctor Glenn Wilson. After each set of questions you can produce a bar graph of your results, either on screen or printer.

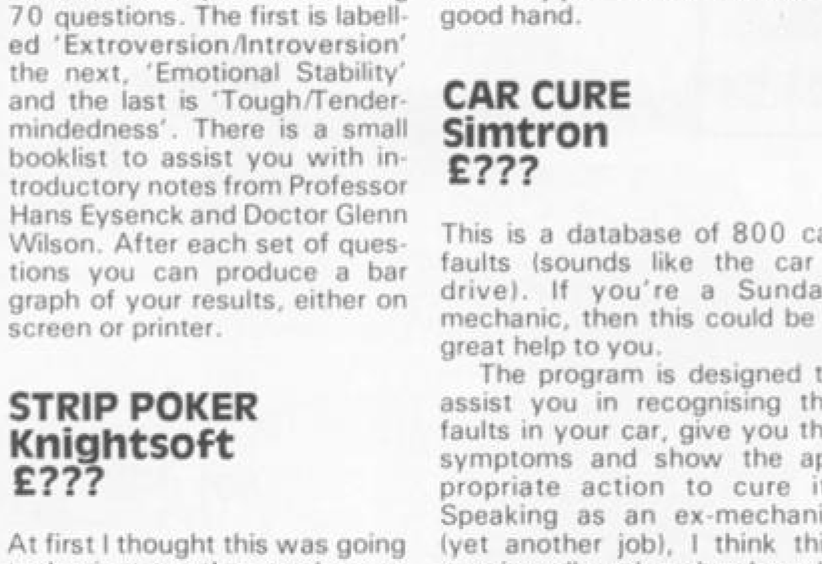
STRIP POKER
Knightsoft
£???

At first I thought this was going to be just another card game which you play with open-minded friends. Instead, you have to play against Mindy, an animated woman. If you are a dab hand at poker, you will see her take off her dress, bra and pants. If you are a feminist, let me add that I did try to ring Knightsoft up to see if there was a male version, but failed to get through.

The animation is well drawn and I have to admit the game did make my palms sweat as I had a good hand.

You both start with £150. Each hand has a maximum of £25. All the features in a poker game are there, such as stand, fold and raise.

I realise this game is a bit of a novelty, but it would stand up on its own for the poker alone.



CAR CURE
Simtron
£???

This is a database of 800 car faults (sounds like the car I drive). If you're a Sunday mechanic, then this could be a great help to you.

The program is designed to assist you in recognising the faults in your car, give you the symptoms and show the appropriate action to cure it. Speaking as an ex-mechanic (yet another job), I think this tape is well produced and would be a worthwhile addition to your toolkit.

The database holds 800 faults and 300 symptoms. The whole program is menu-driven and is very easy to use. The tape is written to cover any vehicle with a 'infernal' combustion engine and doesn't specify particular makes or models (that would take a mainframe).

BIZZICOM
Merlin Software
£14.95

Bizzicom is a business control system for the small trader. There are two parts to this program, on one side of the tape is a stock control and, on the other, a business analysis program.

The stock control program will hold up to 390 items, though I would have thought this too small for most shops. The layout is well done and easy to follow, and there is a small booklet to take you through some of the operation procedures.

You can also keep tabs on your 'on order' situation, and all stock information can be relayed to screen or printer either in part or whole. One of the features I liked was the ability to total the value of stock in cost or retail value. All transactions are carried out into the stock control program but will not keep invoice or cash sale numbers on file. After you have entered your data you then transfer it onto tape. If however, you have 100 transactions you will be told to transfer to a data tape automatically. Then you load the other side of the tape and load in your data. It can handle up to 5 data tapes at once.

This side of the tape gives you a business analysis. When the data is loaded you are asked if it is VAT inclusive, and if not what rate is it. This is then fixed for all data entered. Three reports can be produced — sales, purchaes and orders. As well as these, you also get your VAT payable/recoverable calculated. Finally, there is also a financial trading report. This does not take in outstanding accountd or assets you may have.

There are two versions of the programs, tape and microdrive, but I would advise going for the microdrive as there is a lot of up/down loading. I would also advise you see the program working before you buy it, and see if it suits your business.

Ash Products. PO BOX 510, Birmingham B17 9ES

Mirrosoft. Dunluce House, 4 Canfield Gardens, London

Simitron. Address not given

Merlin Software. Bessemer Drive, Stevenage, Herts.

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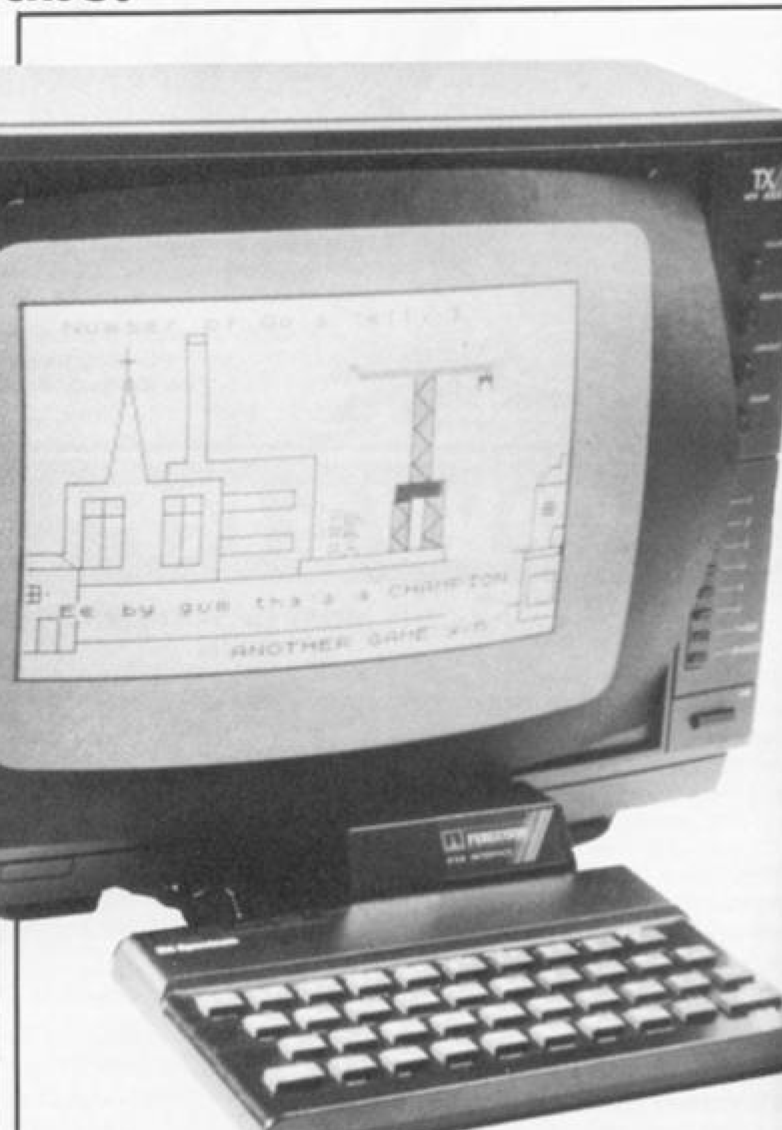
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Ferguson TV/Monitor and Interface

This issue we have an excellent colour TV / Monitor and Spectrum interface up for grabs!





Hello again. For this issue, we have managed to get our hot little hands on a Ferguson MC01 Colour TV/Monitor, specially designed for use with home computers. And, so that you can use it with a Spectrum we have also been given a Spectrum MA20 Interface, and three portable data recorders as runners-up prizes (worth £30 each).

But before we get to the competition, we'll let you hear what our reviewer thought of the TV/Monitor and Interface.

'At first sight, both the MA20 Interface and MC01 TV/Monitor look nice and neat. They are both matte black to match the Spectrum, and the monitor, with a 14-inch screen is large enough to provide a good sized picture, but without being bulky.

Setting up the combination of Spectrum, interface, and monitor was very simple and the instruction manuals didn't require in-depth study before they were understood. One of the good features of the MC01 is that it has what Ferguson call 'switchable control'. What this means is that you can have a TV aerial, home computer, and video recorder all plugged in the set at once, and the MCO will automatically detect whic is being used and react acco dingly. This is an excellent ide and means that all that pokin around the back of your telly an fiddling with miles of wires is n longer necessary — once you'v set all your equipment up yo need never have to swap wire

around again.

The MC01 has eight channels, the first six can be tuned to the TV station of your choice while channel 7 automatically tunes into the computer, and channel 8 tunes into the video. Again this is a good idea as it saves both time and aggravation, induced by having to fiddle with the tuning. The quality of the picture is excellent, and is clearly superior to that of my own telly. This is due to the combination of the monitor and interface together, as the interface allows the signal from your Speccy to go direct to the screen without being modulated and demodulated all over the place (at least, I think that's how it was explained to me).

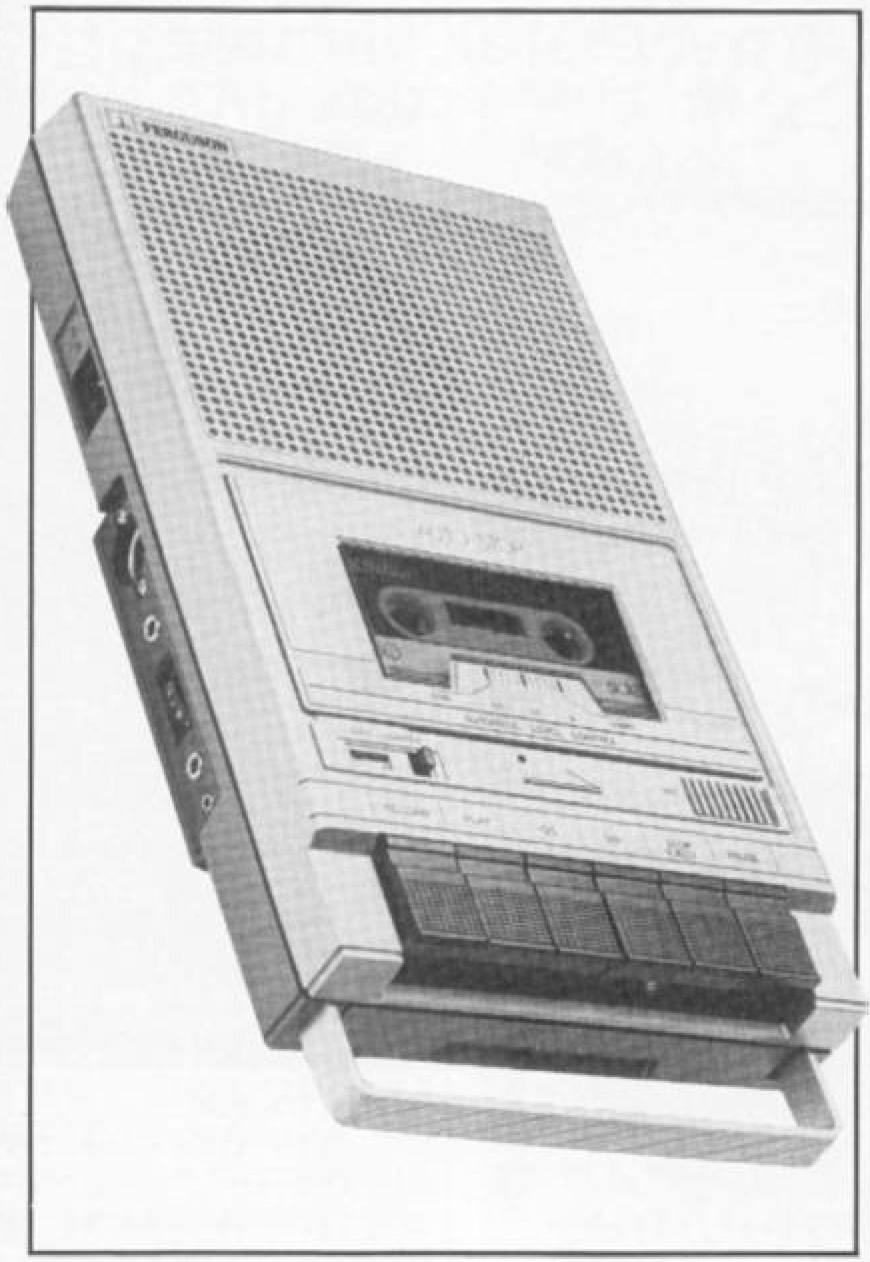
The picture definition is first rate, and there's none of that 'dot crawl' effect you can get on ordinary tellies. I tried out a few games and Alien 8 looked much better than I had ever seen it before. But, I thought, the real test would be to see what sort of picture I get with Tasword's 64 column word processor. And, wonder of wonders, the definition of the half size characters was very good indeed.

Now, a look at the interface: the MA20 is fairly robust and fits snuggly into the Spectrum's rear port with no signs of the wobbling that afflicts so many other interfaces, and can put a strain on the edge connector. Very sensibly, it has a through port which allows you to connect other peripherals, and the shape of the unit actually helps to support whatever additional items use the through connector, so clearly some thought has gone into its design.

As well as a separate output for composite monitors, the interface also has a green screen option, presumably for uses such as word processing, though to be honest I found the ordinary colour picture perfectly adequate when using Tasword.

Two other nice features are the interface's own colour control which allows you to fine tune the colour, and the ability to boost the Spectrum's sound through the TV speaker. This can make a big improvement in the sound output, and when I played Jonah Barrington's Squash, the speech synthesis which was virtually inaudible and indecipherable coming out of the Spectrum, is improved enormously and actually sounds like real speech.

I am, as you may have guessed, impressed by the combination of the TV/Monitor and Interface. Of course, they're not exactly cheap (at £229 and £30 respectively, but then there's no such thing as a cheap monitor) but they do compare well with other units on the market. If I had the necessary money lying around I'd gladly buy them.'



Now, if that has whetted your appetite and you would like to enter this competition, all you have to do is to look at the two lists of features relating to a TV/ Monitor and Interface, and sort them into your order of precedence. Your lists will then be compared to one compiled by Ferguson themselves, and the winners will be those who match Ferguson's own list.

So, if you think that the quality of the picture is the most important feature of a TV/Monitor, then just write that at the top of your list, and then arrange the other features in second, third and fourth position. The same applies to the list for the interface, and all entries must be written on the back of the envelope or postcard.

The Rules

- This competition is open to all UK and Northen Ireland readers of ZX Computing, except employees of Argus Specialist Publications Ltd, their Printers and Distributors, employees of Ferguson and anyone else connected with the competition.
- All entries must be postmarked before 31st September 1985. The prizes will be awarded to the four entrants whose lists most closely match that of Ferguson, and who submit the best tie-break sentences. No correspondence will be entered into with regard to the results, and it is a condition of entry that the Editor's decision is final.
- As long as each entry is sent in an individual postcard/ envelope, there is no limit to the number of entries from each individual.
- The winners will be notified by post, and the results published in a future issue of ZX Computing.

The competition

The features which we want you to put in order of their importance are as follows. For the MA20 Interface (in no particular order):

- Separate monochrome output.
- Through edge connector for extra add-ons.
- Produces RGB signal from the Spectrum.
- Enhanced sound through TV/ Monitor.

and for the MC01 TV/Monitor:

- Automatic switching between computer, video and TV stations.
- Superb picture quality.
- Quick and easy to set up.
- Headphone socket.

And, as a tie-breaker, we would like you to complete the following sentence in, as the saying goes, twenty five words or less:

'I would like a Ferguson TV/ Monitor and Interface because. . . .'

Software Farm

The winners of the Software Farm competition (who kept me up all night for weeks, checking lists of words and spellings) are as follows:

John Robb
Mark Baller
Simon Ferre
D.J.Bauernfeind
P.W.Carver
Steven Simmons
P.Alexander
Brian Owen
Hilary Barret
Peter Grant

Runners up were:

Stephen Green
Ian Howland
R.Traynor
Tess Howland
Robert Murphy
M.Playford
Philip Lawson
Stephen Brennan
R.N.Perry
John Parkes

(And if you think I'm going to type out all the words they sent in their lists then you're crazier than we are!)

All of the above should have received their prizes by the time they read these very words. ■

Machine Code Loader

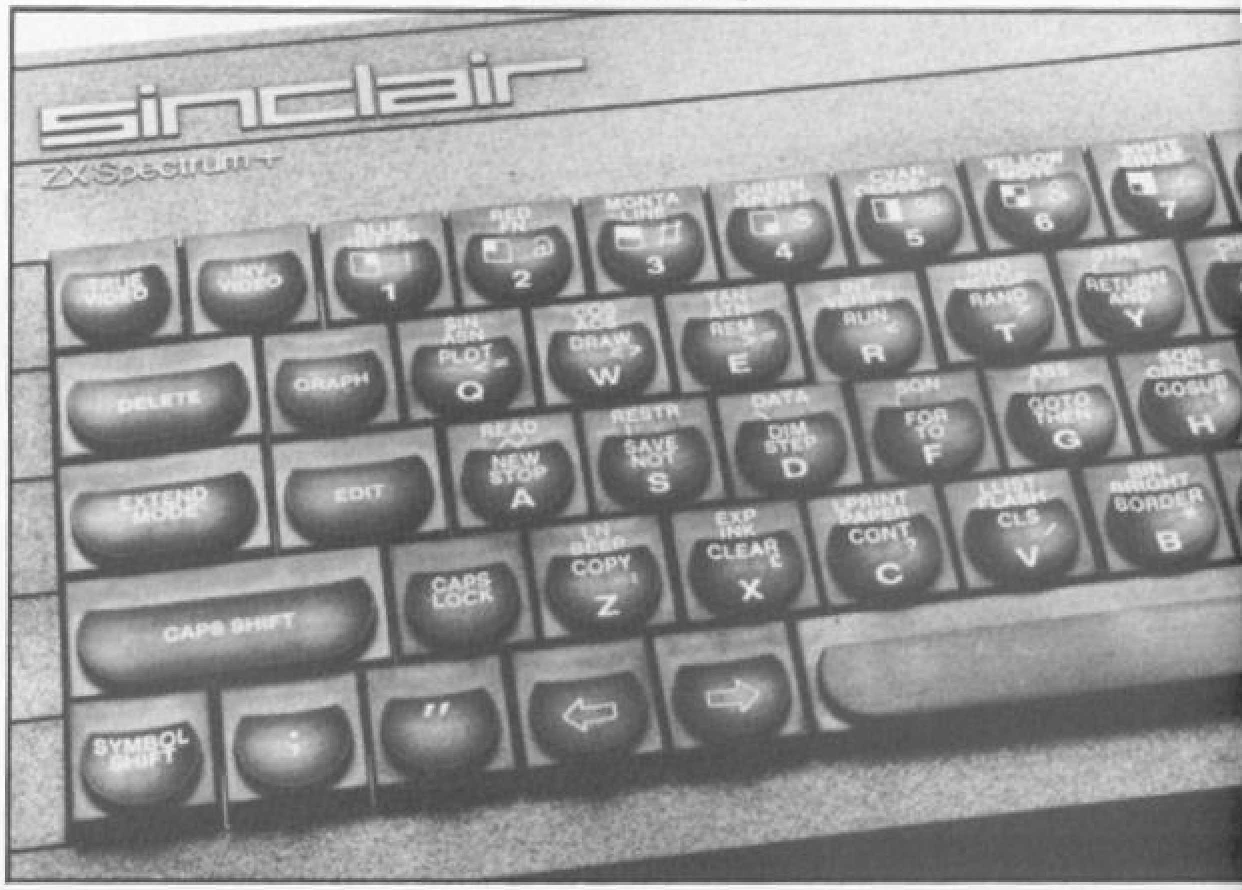
A general all-purpose program to load machine code into the Spectrum memory.

We frequently publish machine code programs for advanced users without including a loader program, this usually brings a spate of letters from ambitious readers who want to enter the program but are confused by the lack of details.

This is a general purpose program aimed at those who would like to enter our machine code programs but lack experience. The program will ask for the start address which may be entered in hex or decimal, but you must indicate which you are giving it by preceeding the address by an 'h' or 'd'. As most programs need the area of memory to be reserved by CLEAR address minus 1, this option is included from within the program.

Sometimes the code is given in decimal and sometimes in hex, the program allows both modes of entry, the main difference being that in decimal mode you can only enter codes one at a time. In hex modes a string of codes may be entered (with no spaces between them) and the program caters for both upper or lower case or even a mixed input!

The addresses and the code poked into them are displayed as they are entered for checking. If you make a mistake then enter 's' to stop, make a note of the error address and re-run the program entering the error address as the start address, do NOT use the CLEAR option, and then continue to enter your codes from where the error ocurred. At any time when prompted for code entry press 's' to stop.




```
   1 REM general machine code
         entry program. Press 's
         to stop.
   2 REM ************************
  10 INPUT "enter start address
          start with H or D to
 indicate   hex or decimal "; LI
NE a$
  20 IF a$(1)="d" OR a$(1)="D" T
HEN  LET addr=VAL a$(2 TO )
  30 IF a$(1)="h" OR a$(1)="H" T
HEN  LET a$=a$(2 TO ): GO SUB 10
00: LET addr=a
  40 INPUT "do you want to clear
 to this    address-1 (Y or N) "
; LINE b$: IF b$="y" OR b$="Y" T
HEN  CLEAR addr-1: LET addr=PEEK
 23730+256*PEEK 23731+1
  50 INPUT "Are you going to ent
er code in  Hex or Decimal (H or
 D) "; LINE b$
 100 IF b$="d" OR b$="D" THEN  G
O TO 200
 110 INPUT "enter hex codes "; L
INE c$
 120 IF c$="s" OR c$="S" THEN  S
TOP
 130 FOR j=1 TO LEN c$ STEP 2: L
ET a$=c$(j TO j+1): GO SUB 1000:
 GO SUB 2000: NEXT j: GO TO 110
 200 INPUT "enter codes one at a
 time "; LINE a$: IF a$="s" OR a
$="S" THEN  STOP

 210 LET a=VAL a$
 220 GO SUB 2000: GO TO 200
 999 STOP
1000 LET a=0: FOR i=LEN a$ TO 1
STEP -1: LET a=a+(CODE a$(i)-48-
(7 AND a$(i)>"9")-(32 AND a$(i)>
"#"))*(16↑((LEN a$)-i)): NEXT i
1010 RETURN
2000 POKE addr,a: PRINT addr;"-"
;a$: LET addr=addr+1: RETURN
```

Spectrum lessons

Mike Edmunds checks his facts with some revision programs.

Exam fever? This month's review packages may be just the medicine for those of you faced with Science examinations. Even if your exams are over they may still come in useful!

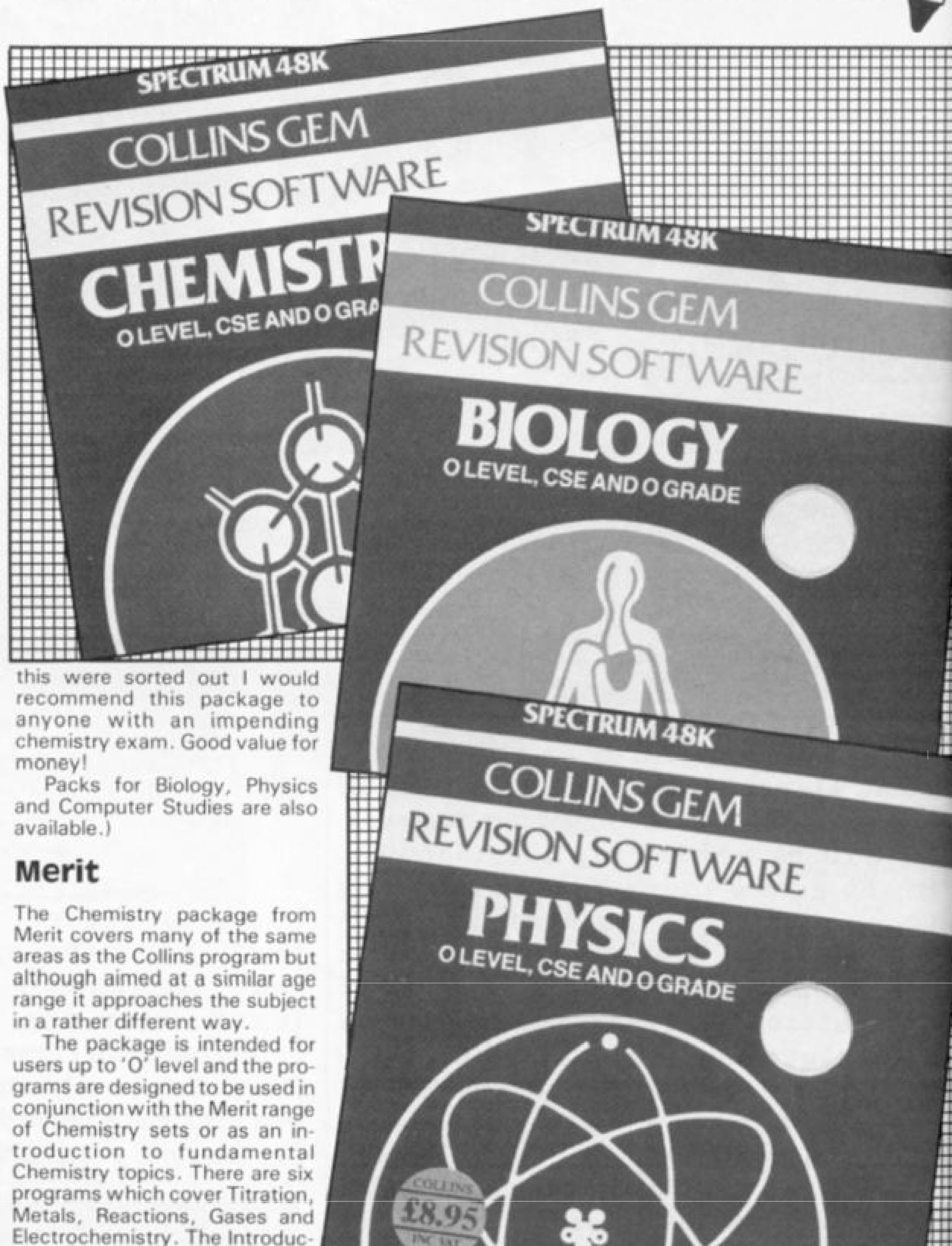
Collins, well known for revision aids in the educational sector have now put together a package containing software and a Gem dictionary of Basic Chemistry facts for students up to 'O' level, CSE and O grade.

The pack consists of a suite of nine programs, being a mixture of Testing, Diagram, Questions and Games. The programs are comprehensive and there are a variety of topics to choose from, ranging from the pH of common substances, Titration, preparation of gases, through to the sources of the elements. The Diagram section revises your knowledge of diagram and the ideas linked with them. Again you have a wide choice of topics and for each topic you can choose whether to have the subject explained to you or to answer questions from two types of test, these being either multiple choice or a simple True/False.

'Questions' jumble up a limited number of different posers and give help if required. The drawback here is that the questions start repeating after a time. The Games program is a Darts 'simulation', in reality just a slightly different way of asking more questions, the hazard being that incorrect responses give points to the computer.

The whole series of program is easy to use and well presented. A redefined character set condenses a lot of information into screen displays and the graphic sequences and diagrams are exceptionally well done. As a revision package I can see this being very useful to most students, incorrect responses are handled well and references to the Gem Dictionary point to possible solutions or areas for further study. One minor error message caused the program to crash and if this were sorted out I would recommend this package to anyone with an impending chemistry exam. Good value for money!

Packs for Biology, Physics and Computer Studies are also available.)



Merit

The Chemistry package from Merit covers many of the same areas as the Collins program but although aimed at a similar age range it approaches the subject in a rather different way.

The package is intended for users up to 'O' level and the programs are designed to be used in conjunction with the Merit range of Chemistry sets or as an introduction to fundamental Chemistry topics. There are six programs which cover Titration, Metals, Reactions, Gases and Electrochemistry. The Introductory program explains how to get the maximum benefit from the package and stresses the safety aspect necessary in the use of such experiments.

The introduction program is, on the whole, a waste of time, detailing, as it does all the available Merit Chemistry Sets and indulging in flashy screen sequences, mediocre graphics and comments which are more suited to a cassette inlay! The program seems to aim at the younger user and is out of keeping with the generally high standard of the rest of the programs. Could this be the first computer advertisement break?

The programs proper though, are of real value to those who need something more than a basic introduction to the areas covered. The simulations are well laid out and, in the often difficult area of Titration for example, help with step-by-step sequences. A wide range of parameters can be changed to suit the user's requirements.

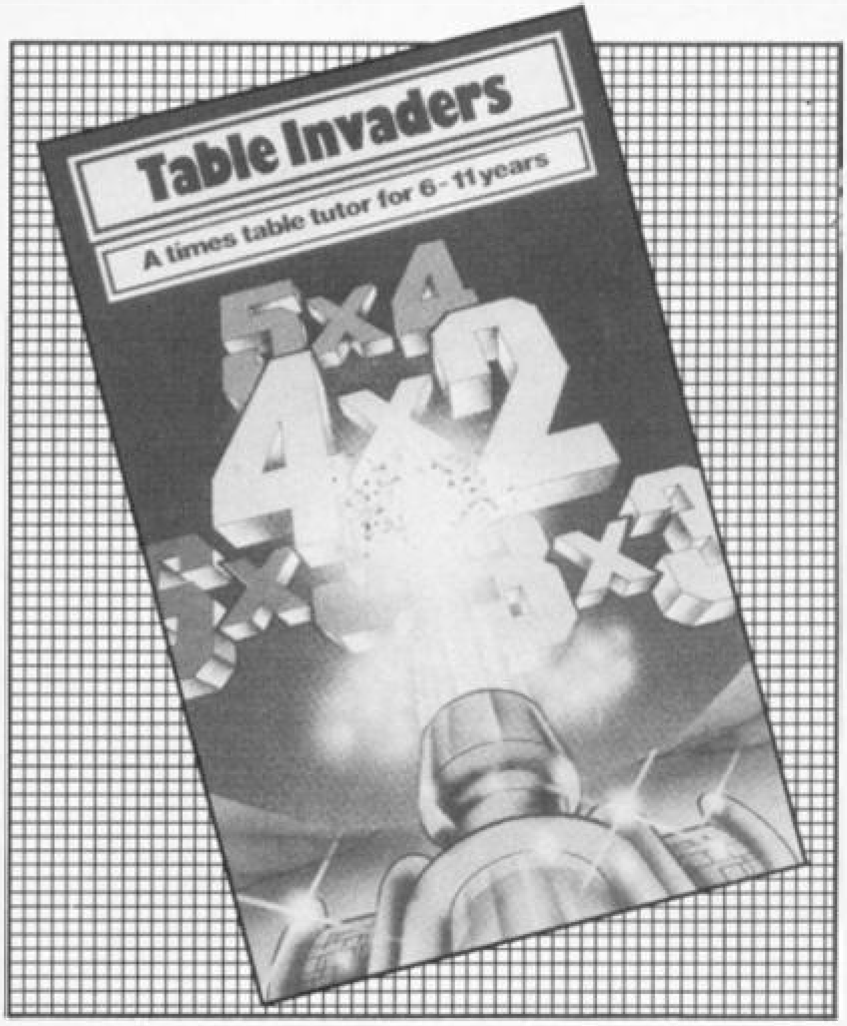
The 'Metals' program comes in two sections; Metal fact-sheets and a Space Adventure game. The fact-sheet tests existing knowledge and suggests areas for further investigation. The game is a Lunar Lander type with hazards! These get more and more complex providing your answers are correct.

'Reactions' improved even this humble reviewer's chemical knowledge, even though I had to use the HELP routine on numerous occasions!

'Gases' contains a data-base of common gases which can be interrogated by the user to compare a range of the properties of these gases. This program also has an investigative game starring Inspector Kluedeau who has to discover the identity of a gas by asking for clues. The whole series of programs uses a variety of techniques to introduce, test and revise chemical facts. Given the comprehensive nature of the programs and the popularity of Chemistry sets(?) together with the price, I think this is a bargain buy if you require a general Chemistry package.

It seems that 'Revision' packages give software companies the opportunity to present a lot of text, spice it up with a few graphics and then ask a lot of related questions. That has been the case with the last two companies and it seems that MegaCYCAL with their Revise Physics is no different. Then again, I suppose we should ask why be different if the formula works?

Many of the comments already made could equally well apply to this program. It provides revision and testing of the main topics in 'O' level and CSE courses. The format is again multiple choice questions, (90 of them) covering six sections; Mechanics, Matter and Motion; Waves, Light and Sound; Electricity and Magnetism; Electrons, Atoms and Nuclei; together with two Miscellany sections.



Menu options lead you through this program, which covers a wide range of questions, based on past examination papers and provides the usual Help option if you appear to be struggling. If Physics is causing you problems or if you just want to brush up your knowledge then try this program. Comprehensive and competent!

Pause . . .

Time to interrupt the secondary science programs with a little light relief from Stell Software in the form of their Tables Invaders/Tables Tutor. This has been around for quite a time now and is a drill and practice program in an Invaders disguise. This is fairly average example of its type and is not really of much use in these heady days of 'computerate' youngsters. Tables Tutor is of far more worth, especially for the younger user and attempts to teach tables knowledge for the 2 to 5 times tables.

The sound, colour and graphics in this section are bound to appeal to young children and learning is made a fun activity. The second part shows, again with appealing graphics, how the tables are developed by using sets of objects. If you need a tables type program then try this.

Finally, to another Revision package in the Science line, this time from SciCal who offer Images, Motion and D.C. These come with fairly hefty teachers' booklets and a software pack which gives the user the opportunity to create scientific 'models' to their own specifications. Menus lead the pupils through the packages and each program contains a wide range of options. I do not profess to be any kind of authority on the subject matter contained within these subject areas but even for me the learning was painless. Text is broken up by effective diagrams and the option to 'tailor' the equations is valuable.

Each program has similar option facilities based upon graphic models. There is a demo



of the basic model and then the option to change given parameters and see the result. I particularly liked the Motion package which, amongst other things deals with velocity, time and distance, acceleration, velocity/time graphs, distance/time graphs and gravity experiments. There is also a test section on each of these areas.

Given that each pupil has different strengths and weaknesses which need to be catered for, I nevertheless found that all the revision packages mentioned this month have a great deal of potential. All provide detailed notes, which of course can be backed up with additional text readers, and each gives a degree of flexibility to the difficult area of exam revision.

With packages such as these I tend to suggest a good book instead but with these packages I feel it would be money well spent. So it only remains to select an area which gives you difficulty and work through some of these programs — they are bound to help. Now all I have to do is await the results of the examinations . . . . . . !

---

1. Revision Software (Chemistry)
Spectrum 48K £8.95
Collins Educational Ltd,
8 Grafton St., London W1X 3LA

2. Merit Chemistry
Spectrum 48K £5.95
J & L Randell Ltd,
Merit House, Cranbourne Rd.
Potters Bar, Herts.

3. Images, D.C., Motion,
Spectrum 48K £ each.
SciCAL Software,
P.O. Box 6, Birkenhead,
Merseyside L43 6XH

4. Revise Physics
Spectrum 48K £8.50
MEGACYCAL
P.O. Box 6, Birkenhead,
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5. Table Invaders
Spectrum 48K
Stell Software,
36, Limefield Ave.,
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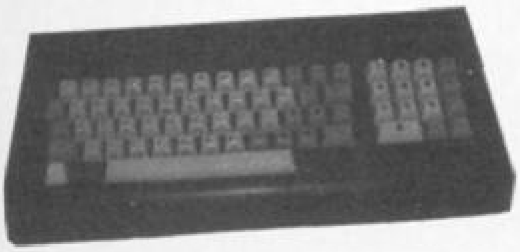
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Demolition Squad

Keep your fingers flexed for this fast action game all the way from Ontario, programmed by Cyrus D. Feyz.

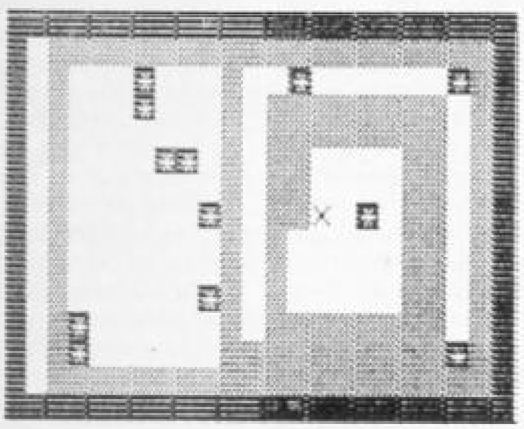


In this game, the player is the one man squad who moves into the enemy field to gain points by disabling enemy posts with as few moves as possible. Each enemy post is shown by an inverse asterisk. The player who acts as a one-person-squad is not allowed to retrace any part of his trail since he might have alerted the enemy about his moves. The boundary of the field is heavily guarded by the enemy and the player must stay away from it.

The game becomes more interesting by offering fields of different sizes in each round, designated in the program as fields 1 to 5 for each level. The levels offer further features of increased number of enemy posts, and off limit stations above level 5.

The moves: up, down, left and right are controlled by the keys W,S,H and J, respectively. The squad continues to move in its direction unless another key is pressed. At the beginning of each game, level and field numbers are displayed, and after the fields are drawn the enemy posts and off limit stations are shown. The player must watch carefully while the enemy posts appear, since the initial position of the squad coincides with the last enemy post or off limit station. Of course, the squad has to move away from its initial position by the count of 20 to avoid losing. Once the task is completed, the squad is discharged by pressing the appropriate key that reverses the squad's direction. At the end of each round a table is displayed which shows: level and field played, moves, point and score.



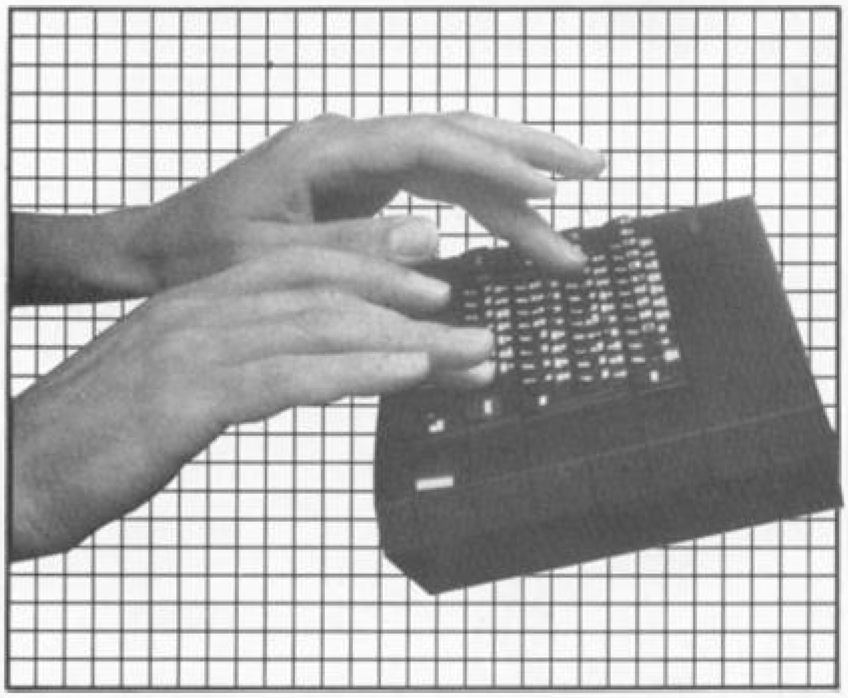


```
LEVEL 2            POINTS  15

FIELD 2/5          MOVES  128
 10 REM DEMOLITION SQUAD
 20 FAST
 30 LET A$="▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒"
 40 LET V=0
 50 LET L=0
 60 REM LEVEL CHANGE
 70 LET V=V+0.05
 80 LET L=L+1
 90 DIM M(5)
100 DIM P(5)
110 DIM S(5)
120 LET A=1
130 LET N=1
140 LET D=25
150 LET R=1
160 GOTO 190
170 REM BOARD CHANGE
180 LET A=A+1
190 LET P=0
200 LET M=0
210 LET S=0
220 SLOW
230 PRINT AT 19,2;"LEVEL ";L
240 PRINT AT 21,2;"FIELD ";A;"/5"
250 PRINT AT 19,18;"POINTS "
260 PRINT AT 21,18;"MOVES  "
270 PRINT AT R,R+1;A$(1 TO D)
280 FOR F=R TO D-10+R
290 PRINT AT F,R+1;"█";AT F,D+R;"█"
300 NEXT F
310 PRINT TAB R+1;A$(1 TO D)
320 FOR J=1 TO INT ((D-2)*(D-10)*V)
330 GOSUB 880
340 PRINT AT F,E;"▣"
350 NEXT J
360 IF L<5 THEN GOTO 410
370 FOR Q=1 TO INT (J/5)
380 GOSUB 880
390 PRINT AT F,E;"█"
400 NEXT Q
410 LET Y=F
420 LET X=E
430 FOR K=1 TO 20
440 NEXT K
450 GOTO 470
460 IF INKEY$="" THEN GOTO 530
470 LET H=0
480 LET I=0
490 IF INKEY$="W" THEN LET I=-1 AND H=H
500 IF INKEY$="S" THEN LET I=1 AND H=H
510 IF INKEY$="H" THEN LET H=-1 AND I=I
520 IF INKEY$="J" THEN LET H=1 AND I=I
530 LET Y=Y+I
540 LET X=X+H
550 PRINT AT Y,X;
560 LET T=PEEK (PEEK 16398+256*PEEK 16399)
570 IF T=128 THEN GOTO 630
580 IF T=136 THEN GOTO 630
590 IF T=151 THEN LET P=P+1
600 LET M=M+1
610 PRINT AT Y,X;"▒"
620 GOTO 460
630 FOR U=1 TO 7
640 PRINT AT Y,X;"▩"
650 PRINT AT Y,X;"X"
660 NEXT U
670 PRINT AT 19,26;P
680 PRINT AT 21,25;M
690 LET P(N)=P
700 LET M(N)=M
710 LET S(N)=INT (P**3/(V*(M/2)))
720 IF INKEY$="" THEN GOTO 720
730 CLS
740 PRINT AT 2,2;"LEVEL ";L
750 PRINT
760 PRINT "FIELD  MOVES  POINTS  SCORE"
770 LET N=1
780 PRINT TAB 2;N;TAB 8;M(N);TAB 16;P(N);TAB 24;S(N)
790 LET N=N+1
800 IF N<=A THEN GOTO 780
810 LET A=A+1
820 LET N=A
830 LET D=D-2
840 IF INKEY$="" THEN GOTO 840
850 CLS
860 IF A=6 THEN GOTO 70
870 GOTO 180
880 LET E=INT (RND*(D-2))+R+2
890 LET F=INT (RND*(D-10))+R+1
900 PRINT AT F,E;
910 IF PEEK (PEEK 16398+256*PEEK 16399)=151 THEN GOTO 880
920 IF PEEK (PEEK 16398+256*PEEK 16399)=128 THEN GOTO 880
930 RETURN
```

Adding the Plus

A. J. Carter looks at the upgrade kit for all those rubbery old Spectrums.



Why bother to add a keyboard to your 48K Spectrum? Well, anyone who has tried to use the standard rubber-keyed keyboard for serious touch typing or word processing will tell you what a sluggish response it has. Also, the plus keyboard has a number of extra keys that Sinclair has seen fit to add after criticism from both customer and the computer media, and what an improvement it is.

So, having decided to give your Spectrum the plus treatment, do you send it off to Sinclair to be converted or take the plunge and do it yourself? Well if you have a screwdriver handy and are competent with a soldering iron, then why not have a go yourself and spend the £10 you save on the latest software release.

Once you have received the kit from Uncle Clive, the first thing to do is to check that all the components are present. This has been made very simple because Sinclair have had the good sense to include an illustrated parts list in the instructions, so, if you're not comfortable talking about reset switches, resistors and heatsinks, you can always match the parts to the pictures. Just so you don't go wrong, comprehensive, illustrated instructions have been included in the leaflet and the conversion process has been broken down into six stages.

Stage 1 details how to dismantle your existing Spectrum keyboard. To do this you must turn the Spectrum upside down and unscrew all the screws on the bass and remove each of them from the holes. At this point it would be useful to have a jam jar lid or something similar to put the screws in because it is very easy to knock them off the surface you are working on and have to spend ages searching around on your hands and knees for the tiny black screws. Once the screws are out turn the Spectrum the correct way up and gently lift the front of the rubber keyed keyboard. You should now be able to see two thin translucent ribbon cables. These connect the computer printed circuit board to the keyboard. Gently remove these from their respective sockets. Try to pull the ribbons from the sockets perpendicularly to the p.c.b. because pulling them at an angle may result in the tracks painted on the ribbons being cracked or damaged rendering your old keyboard useless. After removing the top of the old case, find the single screw that holds the pcb to the bottom half of the case. I found a magnetic screwdriver very handy when removing this screw, as I was able to lift it straight off without dropping in onto the circuit board.

Stage 2 is only necessary if you have a model prior to issue 3, and if so you will need to change the heatsink. To do this you will need a small spanner or nutdriver, or if neither of these are available you could use a pair of narrow jaw pliers to losen the nut. Once the nut has been removed you can replace the old heatsink with the one provided by reversing the above procedure.

Stage 3 is the fitting of the reset switch which involves soldering a lead to a capacitor on the circuit board. This capacitor will be labelled on the board as C27 but as the instructions show, the position of this varies in different issues of the machine. This is the hardest part of the procedure and a great deal of caution should be used to ensure that no blobs of solder are dropped on the circuit as this will damage the computer when the power is reconnected. It was at this point that I got into trouble. I quite naturally inverted the circuit board and soldered the lead to the correct position on the opposite side to the components, as is the normal practise, but when I came to reassemble the unit, I found that the lead on the reset switch was not long enough to allow it to reach its position in the left hand side of the case. So, I desoldered the lead and tried to solder it to the legs of the capacitor, and thankfully this gave the extra length required. When you come to this stage, check to see that the lead is long enough to reach its seating BEFORE you make the connection, otherwise you may end up with a mass of solder on one side that was not required at all.

Stage 4 is testing the keyboard. Once the reset switch is in position, attach the top half of the new keyboard, being careful not to twist the ribbons connecting the keyboard to the computer. Then, fix at least one screw into position to fasten the two halves together. This is because you are going to pow up the computer. Rememb MAINS VOLTAGE CAN KILL, it is important the case does r fall apart when the insides a alive. Test all the keys. If sor don't work then switch off t power and check that the ribb connectors are in position. found that I had pushed one the ribbons only half way which allowed some of the ke to function normally but n others. Having got the othe working try the STOP cor mand. If this does not work th stage 5 must be performe However, if it does then you straight on to stage 6.

Stage 5 If the STOP functi did not work you have anoth modification to do. Find t resistor marked R68 and sold the resistor provided across Once again, you must be caref and avoid solder splashes acro tracks on the circuit board. Ha ing done this, reattach the tw halves of the case and reco nect the power. If STOP s does not work recheck the co nections of the resistor. Disco nect the power and separate th two halves of the keyboard.

Stage 6 is assembling th bottom half of the case. Turn th bottom half upside down so yo can read the wo ''UPGRADED'' which stamped onto the case. Attac the rubber feet in the large holes Set the position of the circu board so that the sockets line u with the corresponding holes the back of the unit and the screw two of the 6.5mm screws into the two holes at th front of the board, and the press the reset switch into th slot on the left hand side of th base. The next thing to do is t fit the legs. Lift the base up, slid the legs into the slots in the bas and place the base back on th work surface, folding the leg up. Lie the leg springs on top o them. Despite the fact they loo loose and sloppy they do wor when the top is attached honest! All that is left to do is r insert the ribbons into th sockets and screwing the to half to the base.

All in all, the instructions ar precise and well thought out and for £20 you get a keyboard that works with 99% of all thir party add-ons and the entir range of Sinclair add-ons, not t mention a very sleek lookin computer. I would like to than Sinclair for the upgrade kit something that would be forgot ten by many other manufac turers, and tell others how glad am that I have had the plus add ed to my Spectrum.

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3D Surfacing

Fascinating and advanced graphics techniques explained by Miles Tindal of Reading.

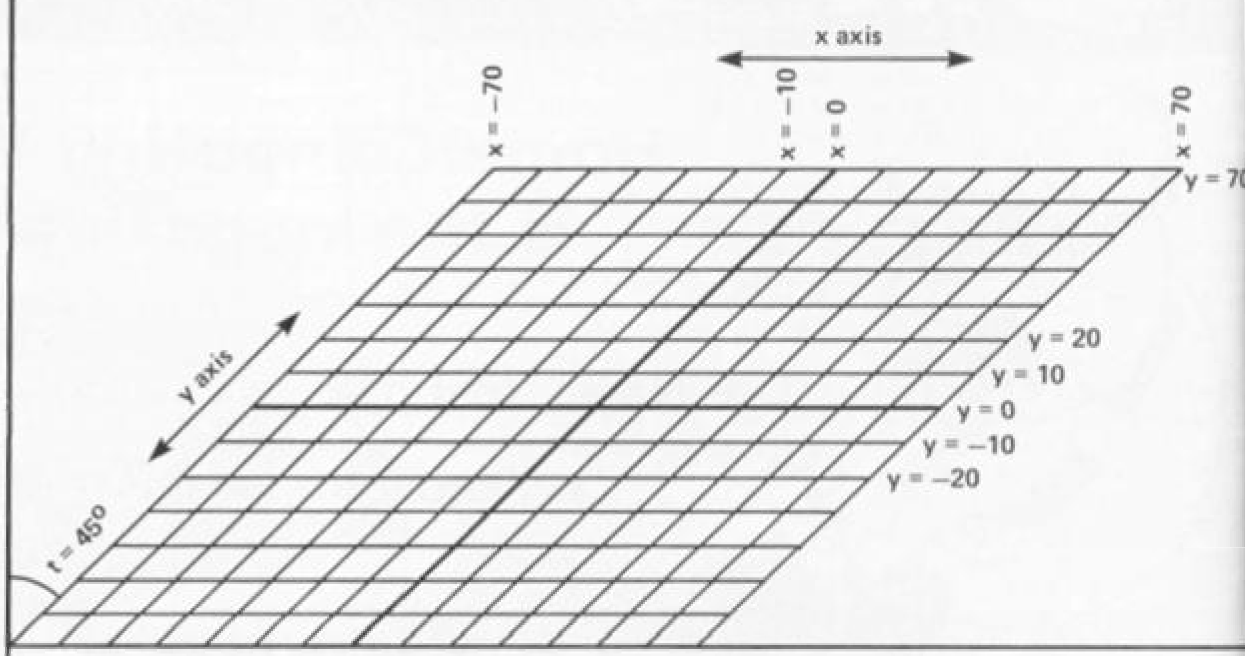


Fig. 1: The flat net before distortion.

The easiest way to represent a three dimensional surface is by the "warped fishing net" method: imagine stretching a square piece of fishing net so that it lies in a horizontal plane (Fig. 1). We will develop a BASIC program to draw any surface described by a mathematical function. The development will be in two stages:

1) Draw a perspective view of the flat net.

2) Distort the net according to some mathematical function.

The Theory

First, however, I will explain the principles involved in representing a three dimensional shape on a two dimensional screen. Any point in three dimensions may be represented as a set of three co-ordinates, i.e. the respective distances that the point is to the right, behind and above a fixed point called the origin (O). The origin, therefore, has co-ordinates (0, 0, 0). This may all sound confusing, but a diagram will make things clear (Fig.2). As you can see, I have called the rightwards direction x, the backwards direction y and the upwards direction z, so the point P has co-ordinates (4, 3, 0). Now, on the television screen we have only two co-ordinates, which I shall call xx and yy. Fig.2 already shows *how to draw a point in three* dimensions on a flat sheet of paper. The horizontal co-ordinate (xx) is made up of x plus some fraction of y. Similarly, yy = z plus some fraction of y. Simple geometry gives us that

xx = x + y cos t — equation 1
yy = z + y sin t — equation 2

where t is the angle which the x axis appears to make with the y axis in two dimensions. Note that this does not give a true perspective view in that objects further away do not seem smaller.

This is the key piece of information for all three-dimensional plotting of any sort, hence the rather long-winded explanation.

Plotting the Flat Net

The net covers the three-dimensional region from x = 70 to x = +70, and from y = −70 to y = +70 (see Fig.1). First, consider the problem of plotting the horizontal lines. (We must PLOT each point individually rather than DRAW whole lines because when the net is distorted from its flat position these lines will no longer be straight). What is required are two nested loops: an "outer" *loop which increases from −70* to +70 in steps of 10, and an "inner" loop which increases x from −70 to +70 and plots each point on the screen. The "vertical" lines of the net are plotted in exactly the same way, this time with x in the "outer" loop and y in the "inner" loop.

Now have a look at the program, but ignore for the moment lines 200 and 210. In line 20, PI/4 is simply 45° in radians. The "business end" of the program has been put into a subroutine. Line 220 calculates where any given point with three-dimensional co-ordinates (x, y, z) should appear on the screen and plots it there. From equations 1 and 2 you might expect this line to read:

PLOT x + y cos t, z + y sin t

The 70 added to x and y appear because our origin is towards the middle of the screen, but the computer plots the point 0, 0 in the bottom left hand corner of the screen. If you now put z = 0 in line 5 and run the program it will draw you the flat net in Fig.1 (VERY SLOWLY!).

Plotting Surfaces

Now we are ready to add a

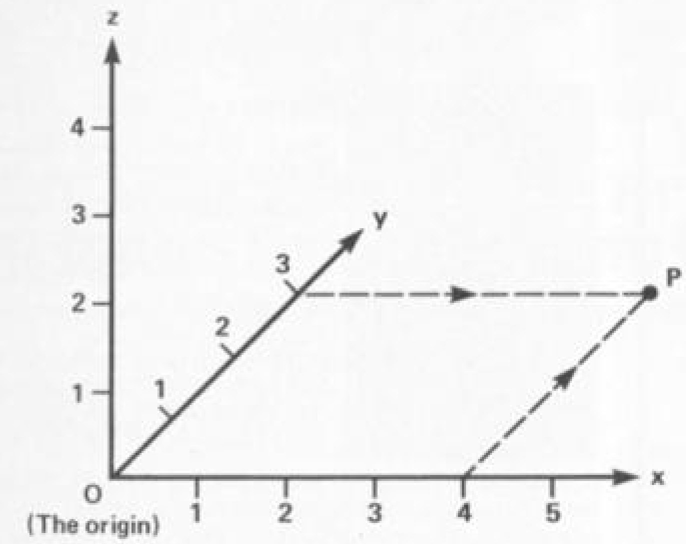
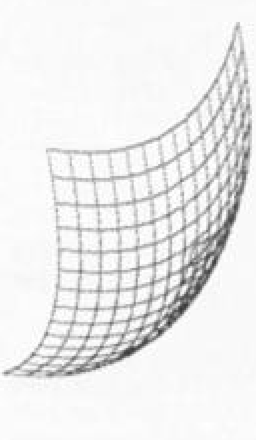
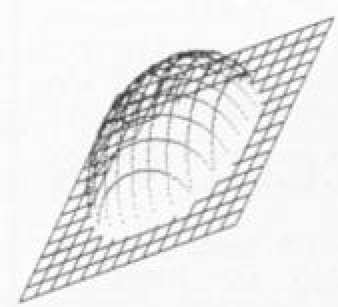
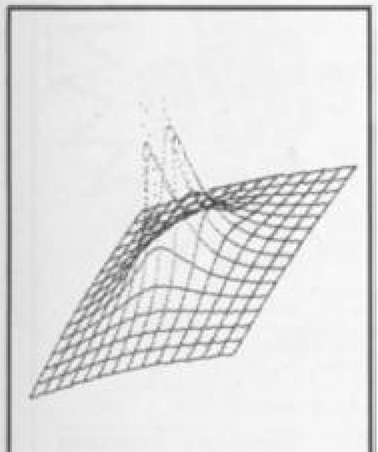


Fig. 2: Three-dimensional drawing on a two-dimensional sheet of paper.

```
 10 BORDER Ø: PAPER Ø: INK 7: CLS
 20 LET t=PI/4
 30 FOR y=-7Ø TO 7Ø STEP 1Ø
 40 FOR x=-7Ø TO 7Ø
 50 GO SUB 2ØØ
 60 NEXT x
 70 NEXT y
 80 FOR x=-7Ø TO 7Ø STEP 1Ø
 90 FOR y=-7Ø TO 7Ø
100 GO SUB 2ØØ
110 NEXT y
120 NEXT x
130 STOP
200 REM Any condition goes here
210 REM Function goes here
220 PLOT 7Ø+x+(7Ø+y)*COS t,z+(7Ø+y)*SIN t
230 RETURN
```







mathematical function. First remove line 5 if you added it in the above section.

1) We shall try the function which describes the repulsion of two similar electric charges (technically a "potential hill"). We want our function to give z (the height of the surface above the flat net) in terms of x and y (the position on the flat net). The function is:

z = 1/SQR (x * x + y * y)

However, this will appear only as the tiniest pimple on the net. To magnify it to a reasonable size it is necessary to multiply z by 1000, so put in line 120:

LET z = 1000/SQR (x * x + y * y)

This function becomes infinite at (O, O), which will make the computer very unhappy. The solution to this problem comes in two stages.

a) Enter:

200 IF x = 0 AND y = 0 THEN RETURN

This ensures that you don't ask the computer to divide by O.

b) Enter:

215 IF z + (70 + y) * sin t > 175 THEN RETURN

This stops you printing off the screen. The reason why there isn't a permanent check for "off the screen" is speed. If your surface does not go off the screen you don't want to slow down the drawing process unnecessarily.

Now RUN the program, go away and have a cup of coffee, and come back to see the finished product. Obviously, since the subroutine is called 4200 times, the more complex the function and condition the slower the program. This one takes about 15 min to run.

2) For our second surface let's try one which is low in the middle and bends up at the corners. The equation is:

z = x * x + y * y

this time z is much too large, so use:

z = (x * x + y * y) /150

and no condition is required, so remove line 200.

3) The Hemisphere. The equation for a hemisphere of radius 50 is:

z = SQR (2500 – x * x – y * y)

Here, you will be trying to find the square root of a negative number if x * x + y * y is > 2500, so impose the condition:

200 IF (x * x + y * y) > 2500 THEN LET z = 0 : GOTO 220

Finally, I will suggest a few functions which may be interesting to look at, but I shall leave you to experiment with what conditions and multiplication factors you need, if any.

z = a * sin (x/10)
z = b * (4900 – y * y)
z = (a * sin (x/10)) * (b * (4900 – y * y))
z = c * x * x * EXP (– x)
z = d * (x * x + y * y) * EXP(– x * x – y * y)

(a, b, c, d should be replaced with numbers — trial and error?) These may get you started, but you can use the program to look at any function which describes z in terms of x or y or both. ■

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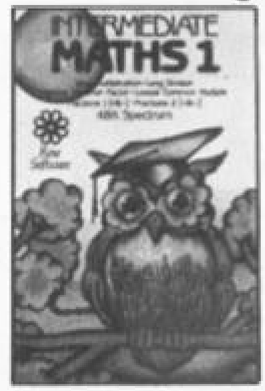
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Inferno



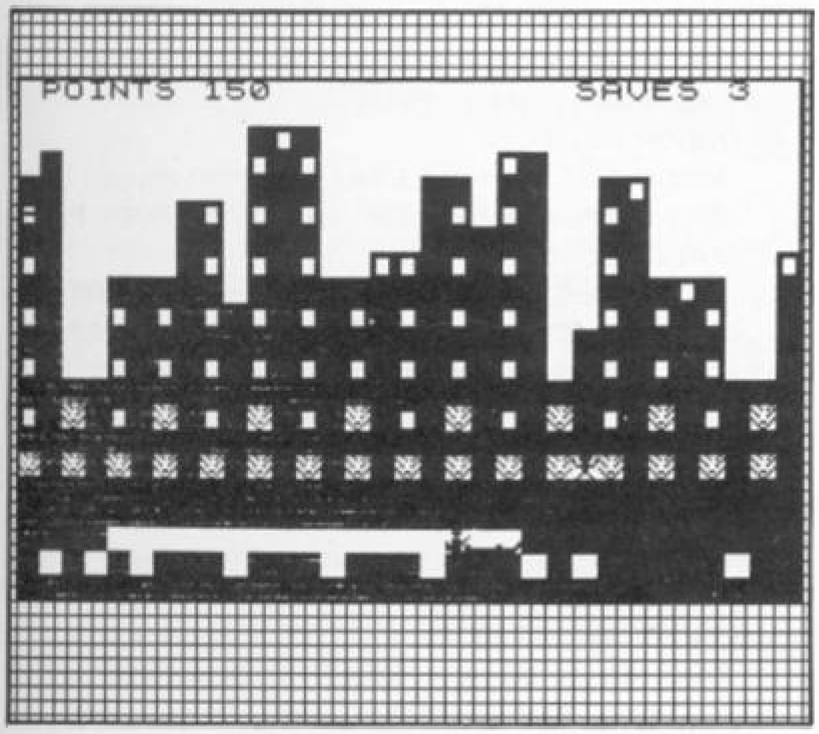
David Peat adds fuel to the fire with this hot little game from burning Mansfield.

The inhabitants of Flaming Towers are getting a little hot under the collar, no wonder really, the whole building has been set alight by an itinerant arsonist. As the flames get higher, more and more occupants decide that the time has come to cast their fate to the winds and their bodies to the river below.

Now, you are having a quiet punt on the aforesaid river and, being of a kindly disposition, try to catch each of the involuntary divers, using keys 1 and 0 to move left and right respectively. Ten ex-residents leap from each level that the fire reaches and you are awarded points for each person caught, depending on the difficulty of the catch as follows:

25 points for high and central windows.
50 points for left and right of centre.
75, 100 and 150 for low and edge windows.

When the fire finally reaches the top of the building then the game ends.



Line by Line

500	Loop 1 to 7 times for fire levels — r
550	Loop 1 to 10 falls per fire level — x
600/ 655	Sets Random fall position — c Allocates fall height — b works out score value — t
700	Start fall, loop from b to 18
710	Checks for catch and if so increments score — a and the value t

Subroutines

5000	move boat right
6000	move boat left
6500	set fire level
7000	instructions
7200	set up graphics
7500	set up screen

```
   1 REM ************************
         *Underlined characters*
         *are entered in       *
         *GRAPHICS mode.       *
         ************************

   2 PAPER 6: BORDER 6: INK Ø
   4 GO SUB 7ØØØ
   5 PAPER 5: CLS
   8 GO SUB 72ØØ
  1Ø GO SUB 75ØØ
  4Ø INK Ø: PRINT AT 1,23;"SAVES
  ";AT 1,1;"POINTS"
  5Ø LET a$="BCD"
  6Ø LET p=Ø: LET s=Ø: LET d=14
  75 PAPER 2: INK Ø: PRINT AT 16
 ,14;"E"
  8Ø PAPER Ø: INK 7: PRINT AT 19
 ,d;a$
 5ØØ FOR r=1 TO 7
 55Ø FOR x=1 TO 1Ø
 56Ø PAUSE 25
 6ØØ LET c=2*INT (RND*15)+1
 65Ø IF c=1 THEN  LET b=4: LET t
 =5Ø
 651 IF c=3 THEN  LET b=13: LET
 t=15Ø
 652 IF c=5 THEN  LET b=9: LET t
 =75
 653 IF c=7 THEN  LET b=6: LET t
 =5Ø
 654 IF c=9 THEN  LET b=1Ø: LET
```

▶

```
t=50
 655 IF c=11 THEN  LET b=3: LET
t=25
 656 IF c=13 THEN  LET b=9: LET
t=25
 657 IF c=15 THEN  LET b=8: LET
t=25
 658 IF c=17 THEN  LET b=5: LET
t=25
 659 IF c=19 THEN  LET b=7: LET
t=25
 660 IF c=21 THEN  LET b=4: LET
t=25
 661 IF c=23 THEN  LET b=11: LET
 t=50
 662 IF c=25 THEN  LET b=5: LET
t=25
 663 IF c=27 THEN  LET b=9: LET
t=75
 664 IF c=29 THEN  LET b=13: LET
 t=150
 665 IF c=31 THEN  LET b=8: LET
t=100
 700 FOR b=b TO 18
 710 IF b=18 AND c=d+1 THEN  LET
 s=s+1: PRINT  PAPER 6; INK 0;AT
 1,29;s: LET p=p+t: PRINT  PAPER
 6; INK 0;AT 1,8;p: BEEP .1,30
 800 PAPER 0: INK 7: PRINT AT b,
c;"A"
 850 IF INKEY$="0" AND d<29 THEN
  GO SUB 5000
 900 BEEP .02,b
 950 IF INKEY$="1" AND d>0 THEN
 GO SUB 6000
 970 IF b=18 AND c<>d+1 THEN  PR
INT  INK 7; PAPER 1;AT 20,c;"E":
 BEEP .1,-15: PRINT AT 20,c; PAP
ER 1; INK 7;" "
1000 INK 0: PRINT AT b,c;"█"
1100 NEXT b
1200 NEXT x
1400 IF r=1 THEN  LET z=24
1450 IF r=2 THEN  LET z=15
1500 IF r=3 THEN  LET z=11
1600 IF r=4 THEN  LET z=13
1700 IF r=5 THEN  LET z=7
1800 IF r=6 THEN  LET z=4
1900 IF r=7 THEN  LET z=3
2000 GO SUB 6500
2100 NEXT r
2150 GO TO 6550
5000 REM ***MOVE RIGHT***
5050: PRINT  PAPER 0;AT 19,d;"
 "
5100 LET d=d+1
5200 PAPER 0: INK 7: PRINT AT 19
,d;a$
5300 RETURN
6000 REM ***MOVE LEFT***
6100: PRINT  PAPER 0;AT 19,d;"
 "
6200 LET d=d-1
6300 PAPER 0: INK 7: PRINT AT 19
,d;a$
6400 RETURN
6500 REM ***FIRE***
6505 FOR w=1 TO z
6510 READ x,y
6515 PRINT  PAPER 2; INK 0;AT x,
y;"E"
6520 NEXT w
6535 RETURN
6550 PRINT  INK 0; PAPER 6; FLAS
H 1;AT 1,8;P: FOR r=1 TO 10: LET
 t=8: FOR n=1 TO 5: BEEP .05,t:
LET t=t+1: NEXT n: NEXT r: BEEP
2,-12
6560 PRINT  INK 7; PAPER 1;AT 20
,1;"**FINISH** Another go? (Y or
 N)"
6570 PAUSE 0
6580 LET x$=INKEY$
6590 IF x$="y" OR x$="Y" THEN  P
APER 6: CLS : RUN 3
6600 CLS : PAPER 6: INK 1: PRINT
 AT 10,5;"THANK YOU FOR PLAYING"
: STOP
7000 REM INSTRUCTIONS
7005 CLS : PAPER 6: INK 2: FLASH
 1: PRINT AT 5,8;"TOWERING INFER
NO"
7010 FLASH 0: INK 0:: PRINT AT 7
,10; David Peat"
7020 PRINT AT 10,2;"Fire rages t
hrough a block of   flats,try to
 catch the people   as they jump
. Move the rescue   boat to the
right with key 0,   and left wit
h key 1"
7035 PRINT AT 17,5;"Press any ke
y to continue"
7045 PAUSE 0
7050 CLS
7060 PAPER 6: INK 0: PRINT AT 3,
2;"The fire rises through the
    building one level for every
    10 jumps until the game ends
    when the fire reaches the top
          Points are awarded for
    the difficulty of the catch.
    25 Points for high and centr-
    al windows, 50 Points for
    left or right of centre,and
```

```
   75,100,150 for low and edge
   windows."
7061 PRINT AT 15,5;"Press any ke
y to continue"
7062 IF INKEY$<>"" THEN  GO TO 7
062
7063 IF INKEY$="" THEN  GO TO 70
63
7065 CLS
7070 PRINT AT 3,2;"The falls are
 from random        positions mak
ing it a gamble     to try to cat
ch only those       falling from
edge windows.       A catch must
be in the middle    of the boat."
7080 PRINT  FLASH 1;AT 15,5;"PRE
SS ANY KEY TO START"
7082 PAUSE 0
7095 CLS
7100 RETURN
7200 REM GRAPHICS
7210 FOR g=65 TO 71
7220 FOR n=0 TO 7
7230 READ l: POKE USR (CHR$ g)+n
,l
7240 NEXT n
7250 NEXT g
7260 RETURN
7300 DATA 60,189,153,126,24,24,3
6,66,56,56,17,58,188,251,251,63,
0,0,0,0,0,0,255,255,0,0,0,0,1,19
5,254,252,255,255,195,195,195,19
5,195,255,34,149,66,36,129,90,36
,24,0,0,60,60,60,60,60,0:
7500 REM BUILDING
7505 LET b$="■■■■■■■■■■■■■■■■■■■■
■■■■■■■■■■■■"
7510 LET c$="E■E■E■E■E■E■E■E■E■E■
■E■E■E■E■E■E■"
7520 LET d$="EE"
7522 PRINT  PAPER 5; INK 1;AT 20
,0;"■■■■■■■■■■■■■■■■■■■■■■■■■■■■
■■■■"
7524 PRINT  PAPER 5; INK 1;AT 21
,0;"■■■■■■■■■■■■■■■■■■■■■■■■■■■■
■■■■"
7525 PAPER 5: INK 0
7528 PRINT AT 19,0;b$
7530 PRINT  INK 0; PAPER 5;AT 18
,0;b$
7540 PRINT AT 17,0;b$
7550 PRINT AT 16,0;c$
7560 PRINT AT 15,0;b$
7570 PRINT AT 14,0;c$
7580 PRINT AT 13,0;b$(1 TO 3);AT
 13,3;c$(1 TO 2);AT 13,5;b$(1 TO
 24);AT 13,29;c$(1 TO 2);AT 13,3
1;b$(1)
7590 PRINT AT 12,0;c$(1 TO 2);AT
 12,4;c$(5 TO 22);AT 12,23;c$(2
TO 7);AT 12,31;b$(1)
7600 PRINT AT 11,0;b$(1 TO 2);AT
 11,4;b$(1 TO 18);AT 11,23;c$(1
TO 2);AT 11,25;b$(1 TO 4);AT 11,
31;b$(1)
7610 PRINT AT 10,0;c$(1 TO 2);AT
 10,4;c$(1 TO 18);AT 10,24;c$(1
TO 5);AT 10,31;b$(1)
7620 PRINT AT 9,0;b$(1 TO 2);AT
9,4;c$(2 TO 4);AT 9,7;b$(1 TO 2)
;AT 9,10;b$(1 TO 2);AT 9,12;c$(2
 TO 4);AT 9,15;b$(1 TO 7);AT 9,2
4;b$(1 TO 3);AT 9,27;c$(1 TO 2);
AT 9,31;b$(1)
7630 PRINT AT 8,0;c$(1 TO 2);AT
8,7;c$(2 TO 3);AT 8,10;c$(1 TO 3
);AT 8,15;d$;AT 8,17;c$(2 TO 6);
AT 8,24;c$(1 TO 2);AT 8,31;d$(1)
7640 PRINT AT 7,0;b$(1 TO 2);AT
7,7;b$(1 TO 2);AT 7,10;b$(1 TO 3
);AT 7,17;b$(1 TO 2);AT 7,19;c$(
1 TO 2);AT 7,21;b$(1);AT 7,24;b$
(1 TO 2);
7650 PRINT AT 6,0;c$(1 TO 2);AT
6,7;d$;AT 6,10;c$(1 TO 3);AT 6,1
7;c$(2 TO 3);AT 6,20;c$(1 TO 2);
AT 6,24;c$(1 TO 2);
7660 PRINT AT 5,0;b$(1 TO 2);AT
5,10;b$(1 TO 3);AT 5,17;c$(1 TO
2);AT 5,20;b$(1 TO 2);AT 5,24;c$
(2 TO 3);
7670 PRINT AT 4,1;d$(1);AT 4,10;
c$(1 TO 3);AT 4,20;d$
7680 PRINT AT 3,10;c$(2 TO 4)
7700 RETURN
8500 REM ***DATA FOR FIRE***
8550 DATA 16,0,16,2,14,2,16,4,16
,6,14,6,16,8,16,10,14,10,16,12,1
6,14,14,14,16,16,16,18,14,18,16,
20,16,22,14,22,16,24,16,26,14,26
,16,28,16,30,14,30
8600 DATA 14,0,14,4,12,4,14,8,12
,8,14,12,12,12,14,16,12,16,14,20
,12,20,14,24,12,24,14,28,12,28
8700 DATA 12,0,12,6,10,6,12,10,1
0,10,12,14,10,14,12,18,10,18,12,
26,10,26
8800 DATA 10,0,10,4,10,8,8,8,10,
12,8,12,10,16,8,16,10,20,8,20,10
,24,8,24,10,28
8900 DATA 8,0,6,8,8,10,6,12,8,18
,6,20,8,31
9000 DATA 6,0,6,10,6,18,6,24
9100 DATA 4,10,4,12,4,20
```

Mindplay

Greg Turnbull looks at games of strategy and tactics

Alien
£8.99

Here we have yet another example of the game of the film of the book of the stage play of the record of the game, and so on. Don't let this put you off though, as this game is a good example of the genre and a fair reflection on the movie "Alien".

Before starting to try and play the game it is necessary to thoroughly read the instructions which come with the package. This is only common sense really and prevents you diving in at the deep end. This helps you to familiarise yourself with the game's menu driven mode of operation, and it is a good idea to get to know the various symbols used in the game. After this has been done it is quite easy to get used to the game's operation, but not necessarily the game itself — which can be difficult.

The game is a fairly realistic and tense representation of the final section of the film, as the crewmembers under your control hunt the alien and try to escape in the shuttle. The catch is that the crew cannot escape without Jones, the ship's cat. This generally means losing several crewmembers while chasing the cat across the ship.

The ship is represented by three floor plans, and you move each individual character from room to room, and floor to floor, collecting items which will help you defeat the alien and catch the cat. Without the right combination of items, the cat invariably escapes your grasp.

The alien, of course, is not just waiting to be hunted, but, unfortunately for you, insists on fighting back! The sound of opening and closing doors coupled with the noise of the tracker provides a warning that the alien is on it's way. Often, your heart beat increases with the sounds, as a stubborn character refuses to follow your directions to safety. Ultimately, the alien will attack — and appear on the screen looking particularly gruesome (even if it does look like it's breakdancing). The appearance of this monster is accompanied by messages informing you of the impending demise of whichever character is under attack. More than once I've panicked under a surprise attack, and so failed to react quickly enough to save my crewmember.

The instructions with the game are quite comprehensive and come complete with a photo-story of the film, up to the point where the game takes over. If the acknowlegdements are to be believed then the game was created by a group of "Alien" fans who have names strangely familiar to those of the characters in the film and game.



"Alien" is one of the more successful of the recent spate of book or film adaptions, such as "Sherlock". Its unique personality control system allows the contol of all the characters, except, of course, the alien! At times, the game is as tense and exciting as the film, a difficult feat to achieve with a computer game. "Alien" embraces features of both strategy games, and adventure, with the addition of a little horror. For this, "Alien" gets top marks in my book.

"Alien" is available from Argus Press Software, Liberty House, Regent Street, London W1.

Clueso

An interesting adventure, this one. At first glance it appears to be a standard text/graphics adventure, from a little known software house, but upon closer inspection it is obvious that "Clueso" has something a little special.

The plot is basically a murder/mystery set in France, as indicated by the loading screen which shows a detective and a window view of Paris, including, of course, the Eiffel Tower. The layout of the game is in the form of a small graphic picture, though not all locations are accompanied with illustrations. Some of these graphics are very nice, and they are all followed by a text description of the location.

This all sounds like pretty standard stuff, and indeed it is, but as I said, this game has that little extra — a sense of humour. One of the first things the player finds is a ringing telephone (complete with sound effect) which when answered is revealed to be a wrong number. Later on, though, the phone plays a more useful purpose. Another nice touch is the use of French. Instead of replying with the boring "I don't understand" when stuck for words, this program uses the French equivalent "Je ne comprend pas". But as with the telephone, the use of French is not only there for variety and a knowledge of the language comes in handy later on.

Overall, "Clueso" is an enjoyable program, with fast responses and a strong sense of humour. This game is recommended — as long as you know your French!

Available from Imperial Software, Imperial House, 153 Churchill Road, Poole, Dorset.

Spiderman
£9.95

Not being a fan of either Spiderman, or Scott Adams adventure, the combination of the two was not particularly appealing to me. This game is packaged similarly to it's predecessor "The Hulk", and comes complete with some rather lacklustre instructions. These instructions consist of an explantion of the adventure game concept, followed by some examples. Both the explanation and examples are rather juvenile. This reveals an unresolved conflict in the game — young Spidey fans may want it, but it's difficulty rating is certainly not for someone new to adventure games, as the instructions would suggest. The game seems to be aimed at both the younger market, and the experienced adventurer, and I feel it fails in both aims.

This adventure can be summed up in a single phrase — "Nice pictures shame about the game." The graphic representations of locations and of Spiderman's enemies are nothing short of stunning, but the game is not of good enough quality to support the graphics, and certainly doesn't do them justice. Stunning graphics, unfortunately, do not make for a stunning game, and "Spiderman" proves this.

The meagre plot consists of collecting diamonds, fighting enemies, and replenishing your spider-web fluid. This, frankly, is all quite boring, so I spent most of my time in the lift shaft.

This is a totally uninspired game, but with excellent graphics. Not recommended, unless you prefer great pictures over a great game. For my money, the latter comes first every time.

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TRADE ENQUIRIES WELCOMED

Micro Music

This month we look at a Midi interface and an alternative system for Casio and Yamaha owners.

In our last issue we featured a large section on Midi — Musical Instrument Digital Interface — but unfortunately there was one unit that didn't arrive in time for that article, but now, as promised, here is our assessment of it.

Electromusic Research Midi Interface

This well made and robust unit, which is distributed by Rose Morris, consists of two neat units connected by a ribbon cable. The smaller of the two units connects to the Spectrum port at the back of the machine and the other box attaches, via a five pin Din plug, to a suitable keyboard. This is a good system as it enables Din leads to be swapped or connected without risk of damage to the computer when it is operating.

I tested the interface with a SIEL DK80, KORG POLY 800 and a JVC KB600, the first two being true synthesizers and the JVC is a typical home keyboard with built in drums and rhythm unit. All these are in the £650.00 price bracket.

Four sockets are provided on the computer, Clock Start/Stop, Midi In, and Two Midi Outs. Two flashing LEDs indicate data in/out state.

Software

Five software programs are available from EMR, three are for the Yamaha DX7, one for the DX9 and one for general purpose use. As the Yamaha synths are expensive, professional instruments, we concentrated on the general purpose program.

The PERFORMER is an exciting program aimed at the experienced musician, but which also has much to offer the less able as well. It simulates a full eight track tape recorder and operates in real time — ie. records what you play as you play it directly from the instrument. There are many features to this program, speed control, track merging, mono/poly modes, transportation, sync and full polyphonic recording of all Midi data including note events, dynamics, modulation controls and voice changes.

The manual is well written and easily understood, and this, combined with a well laid out screen format, made me feel confident in the use of the program within about half an hour of starting. A screen dump is pictured elsewhere on this page.

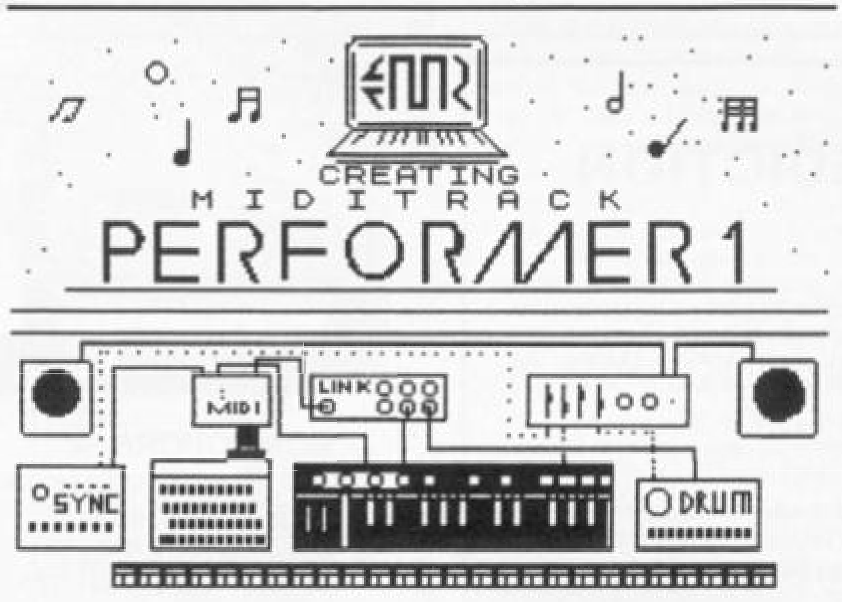
I put track one into record mode and, after an eight beat count which could be altered as desired, recorded a short bass line. The optional metronome kept me in time.

I turned the metronome off, put track two into record mode and recorded a rhythm track as the first track was being replayed. Finally, I recorded on track three a lead line while listening to the other two tracks replaying. Each of the tracks could be assigned to individual Midi channels and the end result was quite impressive. A tape recorder to give similar results would cost over £1200.00!

This interface was the only one out of all those tested which triggered the JVC drum unit and allowed external control over it.

For the experienced player this is a very powerful tool indeed, and the ease of use and variety of re-record and editing facilities make it valuable for those of more limited ability, although as it is all in real time it can be frustrating. There are obviously limitations and one is the massive amount of memory used when full data recording mode is used, it could cut your recording time to as little as two minutes. However, in partial data recording mode compositions as long as fifteen/twenty minutes can be achieved.

During a conversation with Mike Beecher of EMR I asked if he had plans to produce Microdrive/Wafadrive/Disk drive versions of the program as I consider the program much more useful with fast access. He was not certain at first but when I told him how much better it was when I'd converted it to run on the Technology Research disk drive he was very interested and I promised to supply him with a version to convert to all these systems (by now he may have decided to use it). Drop him a line if you are interested.



EMR MIDITRACK PERFORMER V1.1

TRACK	1	2	3	4	5	6	7	8
PLAY								
CHANNEL	1	1	1	1	1	1	1	1
PITCH	0	0	0	0	0	0	0	0
MODE	P	P	P	P	P	P	P	P
CONTROL	F	F	F	F	F	F	F	F

BAR 1	START 1	TIME SIG 4/4
MET Y	TMP 99	CLK I / COUNT 8
S L V [Z]	FREE 31000	PLAY 1

Micro Musician

From Micro Musical comes an exciting system of their own for owners or prospective owners of Casio or Yamaha instruments. Designed primarily for Education and classroom use their equipment has many extra functions which may well attract home users.

At the time of writing they were just completing the writing of the software package in conjunction with some educational experts and were unable to supply use with one for review, however they have promised us one in time for the next issue. Some applications they suggest it could be used for are automatic accompaniment for other instruments, incidental music for shows/plays, enhanced keyboard performance and composition and arranging. We look forward to trying it out, meanwhile give them a ring for more information.

Electronic Research, 14 Mount Close, Wickford, Essex SS11 8HG (also available from Rose Morris distributors).
EMR Interface (approx) £79.90, Performer Software £39.95.

Micro Musical, 37 Wood Lane, Shilton, Coventry CV7 9LA Tel: 0203 616760 (price TBA, but likely to be around £199.00 inc Casio keyboard).

Block Buster

OK Buster, move them blocks! Adam Bull wrote this challenging game based on the arcade hit of Hessle.

This game is a version of a popular arcade game where you must defuse a number of time bombs whilst collecting flags for bonus points, and trying not to get blown up. Your play area consists of blocks and unexploded bombs (which look like skulls and cross bones). You move your man around using the cursor keys, and, as he passes over a block, the block disappears. You will die if you move onto a place where there is no longer a block, and also if you move onto a skull and cross bones. After a random interval, one of the bombs will be activated and it will start to flash. It must then be defused, simply by moving onto it, before the time runs out. The time left until the bomb detonates is shown on the flashing bomb itself. Don't forget you may only move onto a bomb when it is activated! Extra points can be gained by moving onto the yellow flag. After a little while, you will find it getting harder and harder to reach a bomb because of the lack of blocks. To help you get past this difficulty, the ROW of blocks which you are on can be shifted to the left or right using "1" and "2" respectively. It does not matter if an empty space is shifted underneath you, but an unactivated bomb will kill you as usual. After level 2, there will be a row of pink blocks which cannot be shifted. The number of bombs increases on each level, and the time in which you must detonate them decreases. A concise set of instructions is given in the game. You start with three lives. A high score is kept during the game. The screen is wrap-around, so if you go off the side or any edge, you will appear on the opposite side.

When typing in the gam capital letters which do not o viously form words are probab user defined graphic characte and should be typed in as suc They appear in lines:

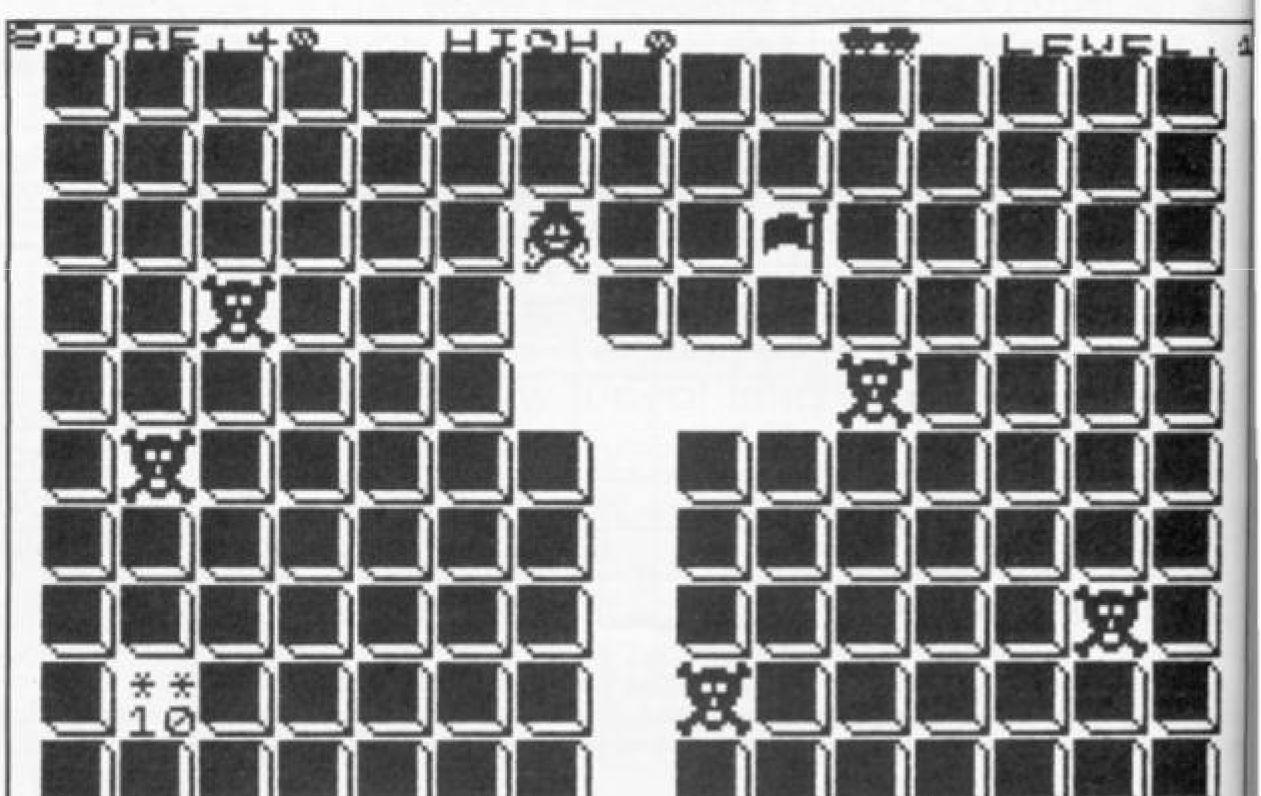
60, 110, 160, 200, 1010, 1040, 4030, 4040, 453(6050

Important sections of the gam are marked with RE statements.

Variables

The main variables used are:

hi	high score.
sc	score during game.
l	current level.
l£	lives left string.
a,b	coordinates of your man (aa,bb saves the last coordinates of a,b).
f1,f2	coordinates of flag.
b1,b2	coordinates of currently activated bomb.
m£ ()	contains the play area — blocks and bombs.
m()	contains the row numbers of the bombs.
bo	bomb number on each level.
t	time left until current bomb detonates.
d	holds the row number of immovable pink blocks.
x£	general string for INKEY$£, etc.
x,y,z	general purpose variables.



Bonus points are given for reaching a flag.

: A safe block

: A flag

: An unactivated bomb

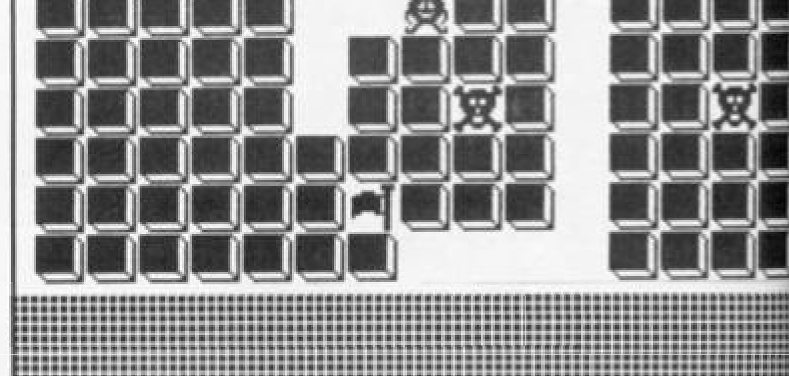
: Your man

Good luck...

```
   1 REM ***********************
         *Underlined characters*
         *are entered in       *
         *GRAPHICS mode.       *
         ***********************
  10 LET hi=0: GO SUB 5000
  20 PAPER 7: BORDER 7: INK 0: B
RIGHT 0: CLS : PRINT "PRESS A KE
Y:~I~ FOR INSTRUCTIONS"
  30 IF INKEY$<>"" THEN  GO TO 3
0
  40 IF INKEY$="" THEN  GO TO 40
  50 IF INKEY$="i" THEN  GO SUB
6000
  60 RANDOMIZE : LET sc=0: LET l
=1: LET l$="PPP "
  70 LET a=19: LET b=15: LET aa=
a: LET bb=b
  80 LET d=-1+(INT (RND*10)*2+2
AND l>2): GO SUB 4000
  90 LET f1=y: LET f2=z: LET t=-
1: LET bo=1: LET b1=t: LET b2=t
 100 REM * MAIN GAME *
 110 PRINT AT f1,f2; INK 6;"DE";
AT f1+1,f2;"FG";AT a,b; INK 7;"L
M";AT a+1,b;"NO"
 120 IF aa<>a OR bb<>b THEN  LET
 sc=sc+2: PRINT AT aa,bb;"  ";AT
 aa+1,bb;"  ": LET m$(aa,bb TO b
b+1)="  ": LET m$(aa+1,bb TO bb+
1)="  ": IF m$(a,b)=" " AND (f1<
>a OR f2<>b) THEN  GO TO 1000
 130 LET aa=a: LET bb=b
 140 IF a=f1 AND b=f2 THEN  BEEP
 .02,20: BEEP .02,25: BEEP .02,3
0: GO SUB 4500: LET f1=y: LET f2
=z: LET sc=sc+20
 150 IF a=b1 AND b=b2 THEN  LET
bo=bo+1: BEEP .03,30: BEEP .03,2
5: BEEP .03,20: LET sc=sc+l*15:
LET t=-1: LET b1=t: LET b2=t
 160 IF m$(a,b)="H" OR t=0 THEN
 GO TO 1000
 170 IF bo>l*3+3 THEN  GO TO 300
0
 180 PRINT AT 0,6; INK 7;sc
 190 IF t>0 THEN  LET t=t-1: PRI
NT AT b1,b2; FLASH 1; INK 6; PAP
ER 2;"**";AT b1+1,b2;"**";AT b1+
(INT (t/2)=t/2),b2;t: BEEP .01,t
+10: GO TO 500
 200 LET y=m(bo): LET z=INT (RND
*15)*2+1: IF m$(y,z)="H" THEN  L
ET t=50-l*4: LET b1=y: LET b2=z:
 LET m$(y,z TO z+1)="■A": LET m$
(y+1,z TO z+1)="BC"
 500 LET x$=INKEY$: IF x$<"5" TH
EN  GO TO 540
 510 LET a=a+(2 AND x$="6")-(2 A
ND x$="7"): LET b=b+(2 AND x$="8
")-(2 AND x$="5")
 520 LET a=a+(20 AND a<1)-(20 AN
D a>19): LET b=b+(30 AND b<1)-(3
0 AND b>29)
 530 GO TO 100

 540 IF x$<>"1" AND x$<>"2" OR d
=a THEN  FOR x=1 TO 15: NEXT x:
GO TO 100
 600 IF x$="2" THEN  GO TO 700
 610 FOR x=0 TO 1: LET m$(a+x)=m
$(a+x,3 TO )+m$(a+x): NEXT x
 620 IF a=f1 THEN  LET f2=f2-2
 630 IF a=b1 THEN  LET b2=b2-2
 640 GO TO 800
 700 FOR x=0 TO 1: LET m$(a+x)=m
$(a+x,29 TO )+m$(a+x): NEXT x
 710 IF a=f1 THEN  LET f2=f2+2
 720 IF a=b1 THEN  LET b2=b2+2
 800 FOR x=0 TO 1: PRINT AT a+x,
1;m$(a+x): NEXT x
 810 LET f2=f2+(30 AND f2=-1)-(3
0 AND f2=31)
 820 LET b2=b2+(30 AND b2=-1)-(3
0 AND b2=31)
 900 GO TO 100
1000 REM * LOSE A LIFE *
1010 FOR x=7 TO 0 STEP -.2: PRIN
T AT a,b; INK x;"LM";AT a+1,b;"N
O": NEXT x
1020 FOR x=50 TO 10 STEP -1: BEE
P .01,x: BEEP .01,x+3: NEXT x
1030 LET l$=l$(2 TO ): IF l$=" "
 THEN  GO TO 2000
1040 IF m$(a,b)="H" OR m$(a,b)="
 " THEN  GO SUB 4500: LET a=y: L
ET b=z: LET aa=a: LET bb=b: IF m
$(a,b)=" " THEN  GO TO 1040
```

```
1050 IF t=0 THEN  LET bo=bo+1: L
ET t=-1: LET b1=t: LET b2=t
1060 GO SUB 4060: GO TO 170
2000 REM * GAME OVER *
2010 PRINT AT 9,0; PAPER 1; FLAS
H 1;"<<<<<< G A M E   O V E R >
>>>>><<<<<<<<<< AGAIN (Y/N)? >>>>
>>>>>"
2020 IF sc>hi THEN  LET hi=sc: G
O SUB 4070
2030 FOR x=1 TO 50: BEEP .004,x
2040 IF INKEY$="y" THEN  GO TO 2
0
2050 IF INKEY$="n" THEN  STOP
2060 NEXT x: GO TO 2030
3000 REM * NEXT LEVEL *
3010 LET l=l+(l<9): LET x$="SUPE
R BONUS =-= SUPER BONUS =-= "
3020 FOR x=1 TO 50: PRINT AT 21,
0; INK 6; FLASH 1;x$: BEEP .01,x
: LET x$=x$(2 TO )+x$
3030 LET x$=x$( TO 32): NEXT x
3040 LET sc=sc+55*l: GO TO 70
4000 REM * SET UP SCREEN *
4010 PAPER 0: INK 5: BORDER 0: B
RIGHT 1: CLS
4020 DIM m$(20,30): DIM m(l*3+3)
4030 FOR x=1 TO 20 STEP 2: LET m
$(x)="■A■A■A■A■A■A■A■A■A■A■A■A■A
■A■A": LET m$(x+1)="BCBCBCBCBCBC
BCBCBCBCBCBCBCBCBC": NEXT x
4040 FOR x=1 TO l*3+3: GO SUB 45
00: LET m$(y,z TO z+1)="HI": LET
 m$(y+1,z TO z+1)="JK"
4050 LET m(x)=y: NEXT x
4060 FOR x=1 TO 20: PRINT AT x,1
; INK 5-(2 AND (x=d OR x=d+1));m
$(x): NEXT x
4070 PRINT AT 0,0; BRIGHT 0; INK
 7;"SCORE:";sc;TAB 11;"HIGH:";hi
;TAB 21;l$;TAB 25;"LEVEL:";l
4500 REM * RANDOM POSITION *
4510 LET y=INT (RND*10)*2+1
4520 LET z=INT (RND*15)*2+1
4530 IF m$(y,z)="H" OR y=19 AND
z=15 THEN  GO TO 4510
4540 RETURN
5000 REM * U.D.G. DATA *
5010 FOR x=0 TO 127: READ y: POK
E USR "a"+x,y: NEXT x: RETURN
5020 DATA 248,244,242,242,242,24
2,242,242,255,255,255,255,64,32
5030 DATA 31,0,242,242,242,242,1
0,6,254,0,0,0,15,63,127,127,127
5040 DATA 127,60,60,24,248,216,2
16,216,216,127,112,64,0,0,0,0,0
5050 DATA 216,248,24,24,24,24,24
,0,96,231,255,63,57,57,63,30
5060 DATA 12,206,254,248,56,56,2
48,240,30,15,28,60,247,227,96,0
5070 DATA 240,224,112,120,222,14
2,12,0,7,7,63,15,31,61,57,63,192
5080 DATA 192,248,224,240,120,56
,248,123,92,79,39,12,88,112,0
5090 DATA 188,116,228,200,96,52,
28,0,60,255,90,126,165,24,36,66
6000 CLS : PRINT "BLOCK BUSTER"'
"------------"'''"Use the cursor
keys to steer theman around the
screen.If you go off one edge of
 the screen you  will appear on
the opposite side"
6010 PRINT '"You must defuse the
 time bombs  before they detonat
e, but you   may only do this on
ce they are  activated."
6020 PRINT '"You may not move on
to an empty  space, or onto an u
nactivated   bomb."
6030 PRINT '"The ROW of blocks y
ou are on canbe shifted left or
right using  keys ~1~ and ~2~.Th
is may help  you to reach a bomb
, etc."
6040 PRINT '"Bonus points are gi
ven for      reaching a flag."
6050 PRINT '''"■A : A safe block"
'"BC"'''"DE : A flag"'"FG"'''"HI :
 An unactivated bomb"'"JK"'''"LM
: Your man"'"NO"''''"Good luck...
"''''"PRESS ANY KEY"
6060 IF INKEY$="" THEN  GO TO 60
60
6070 RETURN
```



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What Does It Do?

John Ure decided to find a practical answer to this oft heard question, Birmingham will never be the same.

Printing Perspiration

Having owned a Spectrum for almost a year, it seemed like a good idea to put it to work. Perhaps I was influenced by all those friends and relatives who, on hearing that I owned a computer, would insist on asking the dreaded question — "Very nice, but what does it do?"

As all you midnight hackers out there will know, this becomes a rather tedious question which, horror of horrors, you find you cannot satisfactorily answer. Demonstrations of your incredible data file program, or of the fantastic computerised home accounts, are met with blank stares and, after a few seconds, with the inevitable response — "Wouldn't a little notebook be much better?" Trying to tell your maiden aunt that owning a computer gives you a distinct advantage in this high-tech world of ours rubs a little thin when she spots you trying to beat your high score in Jetpac! So, a decision had to be made. The Spectrum was going to be made to earn a living. The cynics had to be shown that a computer was an invaluable aid in the modern household. Now all that remained for me to do was to find an actual use for a machine which had consumed every second of my spare time for the last 12 months!

Get A Keyboard

Even the most ardent Sinclair fan would be forced to admit that Uncle Clive appears to know nothing about keyboards. the first acquisition on my quest for a "working" Spectrum would have to be a professional keyboard. After studying the adverts and the reviews, I decided on the Fuller FDS. Fuller appeared to be the market leader at the time and, despite rumours that their Mail Order Department was modelled on the fast and efficient service we have all come to expect from Sinclair Research, a cheque was duly despatched.

All firms in the computer business would have us believe that 28 days really means three months but, surprise surprise, the



Fuller FDS arrived without delay. I won't dwell on the ins and outs of actually fitting the keyboard, suffice it to say that the "five minutes with a screwdriver", so beloved of keyboard manufacturers, became 60 minutes of blood, sweat and tears. Much of my relief I eventually got the system properly connected and then wondered why it hadn't taken me just five minutes. My only excuse can be, that confronted with an instruction leaflet and a screwdriver I'm immediately transformed into a gibbering idiot.

(Welcome to ZXC, We're all gibbering idiots here — Ed.)

A Proper Printer

Armed with my new keyboard I would hack away into the early hours of the morning without a care in the world. A real keyboard made programming so much more pleasurable that I was steadily falling into my old ways, neglecting my self-imposed quest. When news came of Sinclair's decision to stop manufacturing the ZX Printer, I was brought back to earth with a crash (pun intended). The quest was renewed. I would have to buy a "proper" printer.

In his wisdom, Uncle Clive did not provide an internal printer interface for the Spectrum. So, not only would I have to decide on which printer to buy, but I would also have to find a suitable interface to drive the thing. A firm called Data Plus came to the rescue. For £300 I could buy a complete print package, comprising a daisy-wheel printer (Smith-Corona TP 1); a suitable interface (ZX LPrint III from Euroelectronics) and a word processing program (Tasword from Tasman Software). I realised, of course, that dot-matrix printers were so much more flexible, but I knew that only a daisy-wheel printer could give me the print quality I was looking for. Another cheque was popped in the post. My bank account was being drained as quick as a Welsh reservoir in a drought.

Data Plus were even more efficient than Fuller. Barely two weeks had passed when the postman struggled to the door with one of the biggest parcels I've ever seen. The printer had arrived.

The next stage was to get the interface, the software, the computer and the printer connected. Following the instructions, I managed to do this in under 10 minutes. This being something of a record for me, I wondered what I had done wrong and spent the next 20 minutes making sure I had connected everything up properly. Amazingly, I had! What would go wrong?

The answer came quickly enough. The interface instruction leaflet contained different printer codes from those supplied with the software. Not only that, but the interface seems to think it is attached to a ZX81 ie it has a severe case of the "wobbles". Eventually, after much trial and error, I got the system working. The print quality is truly amazing — every bit as good as the electric typewriter I use at work. Now my only problem is to find a solution to the Tasword program crashing for no apparent reason. Is it a "dodgy" tape, or is it due to the "wobbly" interface? I have asked Tasman for their opinion and, at the time of writing, am waiting for a reply. All I need now is a disc-drive. Anyone out there with any ideas?ı Being much pleased with my "new" Spectrum, I proudly displayed it to a certain maiden aunt. "Very nice, dear. Don't you think a new typewriter would have been better?" You can never convince some people!

Voyage of Peril

Ooh Arr me hearties, there'll be much work for Spectrum owners who will be envious of this ZX81 graphic adventure game from Norman Brooks!



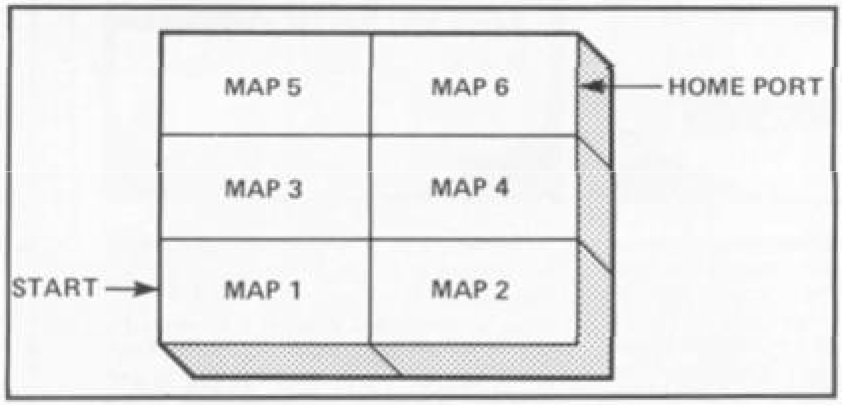
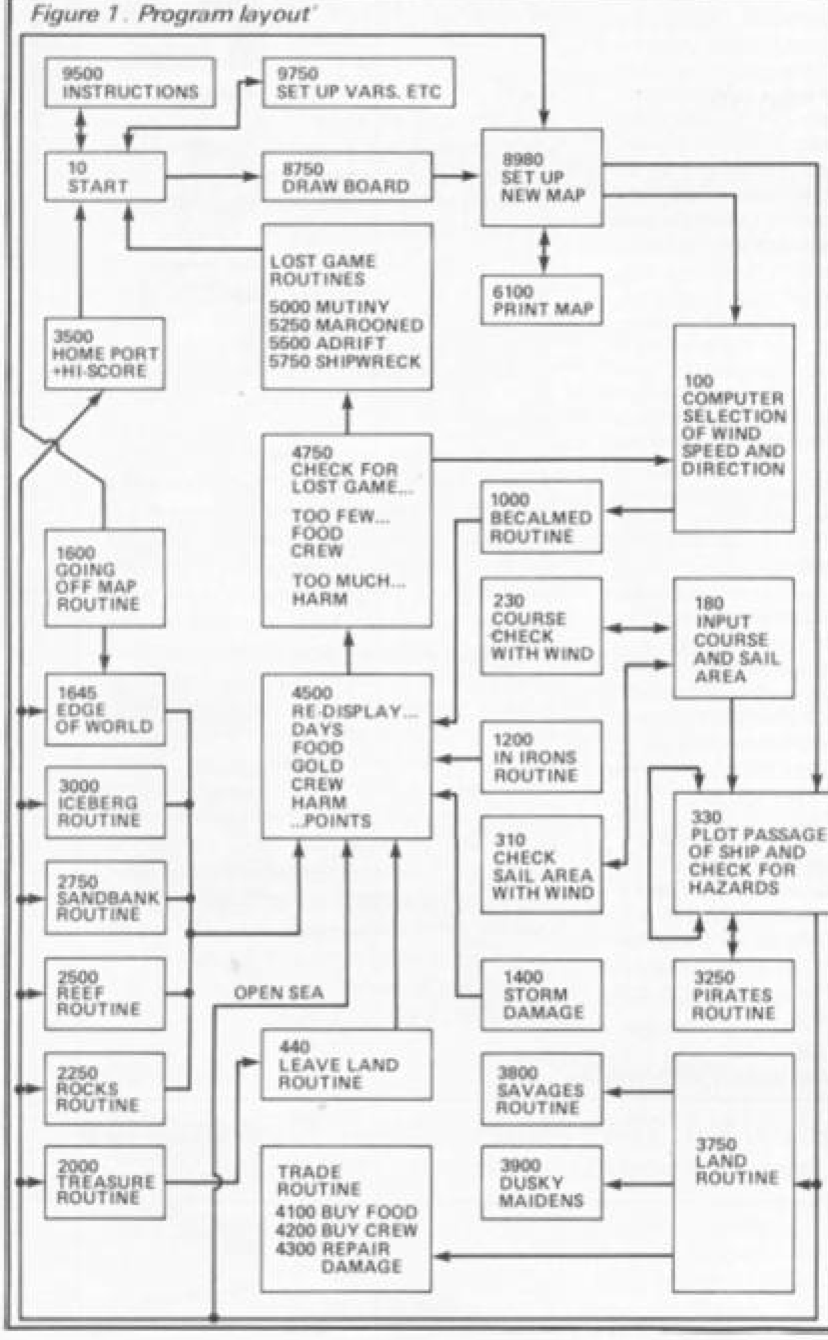


Figure 1. Program layout



A life on the Ocean Waves can be full of danger but you, as Captain of HMS BOUNTY, have a duty to your country to return to your Home Port carrying as much Gold as you can get your hands on. . .

Instructions

From a position at anchor in the bottom left hand corner of Map 1 you may sail in any direction you choose and you can deploy as much sail as your crew is able to hoist. However, beware that the wind is not Gale or Storm Force as it may tear your sails and damage your masts. remember as well that your ship cannot sail within ±45 degrees of the wind direction or else your sails will flap uselessly in the breeze. If the wind force is 0 you will be becalmed for a day; if a Hurricane force 12 blows then batten down the hatches!

On your voyage you will encounter Hazards. These are shown graphically in figure 2.

There are 26 TREASURE points spread over the six Maps which are shown as Graphic A to Z. Land on these and your coffers will start to bulge.

Oh. . . by the way. . . you may be attacked by PIRATES at any time whilst at sea (your chances of this happening are 1 in 250 each time the ship is plotted in open sea).

Your crew eats one food ration per man per day and if provisions run out you will have MUTINY on your hands. Too much ship damage will result in SHIPWRECK and if your Crew Strength is too small, sailing the ship will be impossible, and you will find yourself MAROONED on land or ADRIFT if at sea. Any of these occurences results in lost game.

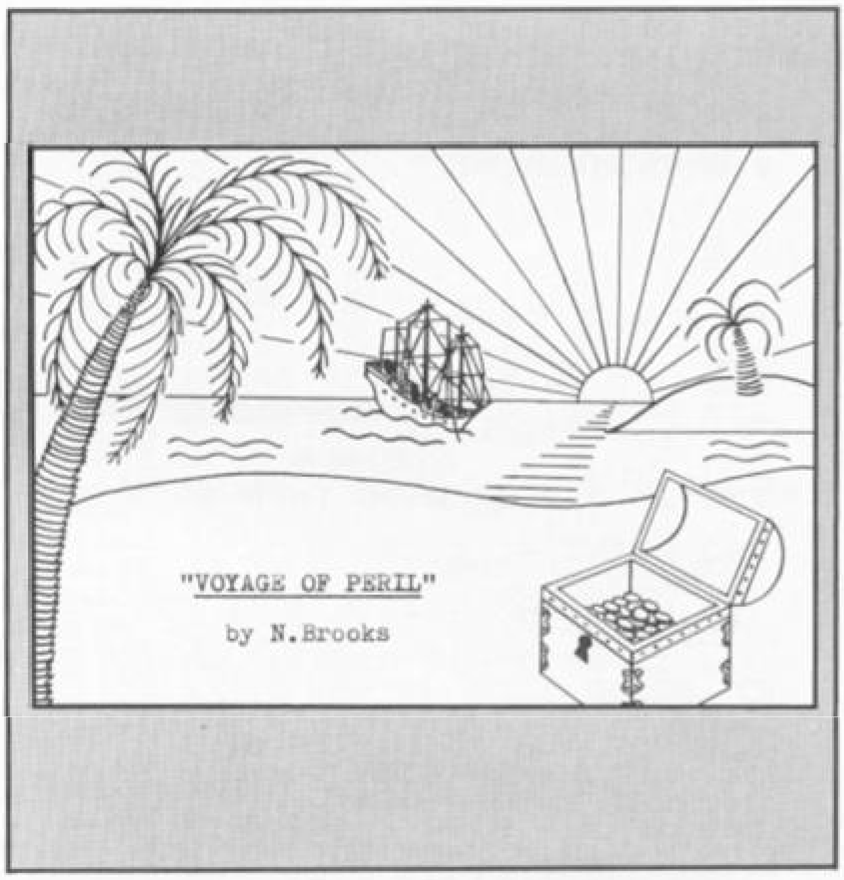
If, on the other hand, you reach your HOME PORT shown as "□" in the top right hand corner of Map 6 then you have achieved your objective and the size of your Gold haul will determine the degree of your success. I suggest that you always try to beat your previous Hi Score and congratulate yourself according to the guide in figure 3.

Figure 2. Hazards you will come across.

ROCKS	Your ship will be damaged.
REEF	Your ship will be damaged.
ICEBERG	Your ship will be damaged.
SANDBANK	Your ship is stuck fast for 1 day.
LAND	(Graphic A) You have (a) a 20% chance of being attacked by Savages, (b) a 20% chance of losing some of your crew to Alluring Maidens or (c) you will be offered the chance to Trade. You can buy Food, take on Crew and Repair damage provided you have enough Gold to pay for the transactions.

Figure 3. How to judge your score.

Gold Pieces	Success
Under 1000	You started the game with 1000 gold pieces so was it worth the effort?
1000-2500	You can probably just afford to pay off the remaining crew.
2500-5000	Your voyage was a moderate success.
5000-7500	Well done, you have made a handsome profit.
Over 7500	Your Fortune is made and promotion to Admiral is a certainty.



Program Notes

LOAD "PERIL" and then RUN the program. In order to fit the program into 16K, I have had to remove all the REM statements. These were as indicated in figure 4.

Figure 4. REM Statements for 48K version.

Line No	Statement
100	Main program
180	Input course and sail area
230	Check course with wind direction
310	Check sail area with wind force
330	Plot ship passage and check location
1000	Becalmed routine
1200	In Irons routine
1400	Storm damage routine
1600	Going off map routine
1645	Edge of world routine
2000	Treasure routine
2250	Rocks routine
2500	Reef routine
2750	Sandbank routine
3000	Iceberg routine
3250	Pirates routine
3500	Home port routine including Hi-Score display
3750	Land routine
3800	Savages attack routine
3900	Dusky Maidens routine
4000	Trade routines:
4100	Buy food
4200	Take on crew
4300	Repair ship damage
4400	Leave land routine
4500	Display Days, Gold, Food, Crew and Harm points
4750	Check for lost game:
5000	Mutiny routine
5250	Marooned routine
5500	Adrift routine
5750	Shipwreck routine
6000	Clear message area
6100	Print new map
7250-8500	Create map arrays
8750	Draw board
8980	Call new map array
9500	Instructions
9750	Set up variables and arrays

Major variables

G	Gold points
HG	Hi-Score gold points
F	Food rations
CS	Crew strength
H	Health points (Harm = 100 – H)
H1	Storm damage
HL	Previous health points
WF	Wind force
WD	Wind direction
SA	Maximum sail area hoistable by available crew.
A	Inputted sail area
C	Inputted course
Q(26)	CHR$ CODEs of treasure points
T	Days into voyage
N	Map number
D	Distance ship may travel
Z	Flag to re-display scores
X,Y	Coordinates of ship position
X1,Y1	Coordinates of last ship position
X2,Y2	Coordinates of ship at end of previous day
L,K	Conversion of X,Y into PRINT coordinates
L1,K1	Conversion of X1,Y1, into PRINT coordinates
D$(15,25)	Map array
T$	Type of trade chosen (e.g. Food)
P$,Q$,R$,S$	Memory saving messages

```
  10 REM "PERIL"
  20 LET HG=0
  30 RAND
  40 GOSUB 9500
  42 PRINT AT 21,0;"PUSH ANY KE
Y TO PLAY ON"
  43 PAUSE 4E4
  44 PRINT AT 21,1;"PLEASE WAIT
"
  45 GOSUB 9750
  50 GOTO 8750
 105 GOSUB 6000
 110 LET WF=INT (RND*8)
 115 IF WF=0 THEN LET WF=INT (RN
D*8)
 120 IF WF=7 THEN LET WF=WF+INT
(RND*5)
 130 IF WF=11 THEN LET WF=WF+INT
(RND*2)
 140 LET WD=INT (RND*360)
 150 PRINT AT 2,1;"WIND FORCE ";
WF;
 152 LET F=(F-CS)*(F>CS)
 154 LET T=T+1
 160 IF WF=0 THEN GOTO 1000
 170 PRINT ", ";WD;" DEG.FROM N"
```

```
 180 PRINT TAB 1;"COURSE? (DEG.C
LOCKWISE FROM N)"
 190 INPUT C
 200 IF C<0 OR C>359 THEN GOTO 1
90
 210 PRINT AT 3,7;"
              "
 220 PRINT AT 3,8;C;" DEGREES FR
OM N"
 230 IF ABS ((C+360*(C<45 AND WD
>315))-(WD+360*(C>315 AND WD<45)
))<45 THEN GOTO 1200
 240 LET C=PI*C/180
 250 LET SA=50*CS
 260 PRINT TAB 1;"SAIL AREA? (MA
X. ";SA;" SQ.FT.)"
 270 INPUT A
 280 IF A<0 OR A>SA THEN GOTO 27
0
 290 PRINT AT 4,10;"
             "
 300 PRINT AT 4,11;A;" SQ.FT. HO
ISTED"
 310 IF WF>6 AND A>500*(12-WF) T
HEN GOSUB 1400
 320 LET D=.00001*A*WF**1.5*H
 330 FOR R=0 TO D STEP 2
 340 LET X=X2+R*SIN C
 350 LET Y=Y2+R*COS C
 360 IF X<-.5 OR X>=49.5 OR Y<-.
5 OR Y>=29.5 THEN GOTO 1600
 370 UNPLOT X1+12,Y1+2
 380 LET L1=15-INT ((Y1+.5)/2)
 385 LET K1=1+INT ((X1+.5)/2)
 390 LET L=15-INT ((Y+.5)/2)
 395 LET K=1+INT ((X+.5)/2)
 400 PRINT AT 5+L1,5+K1;D$(L1,K1
)
 410 PLOT X+12,Y+2
 420 IF R=0 OR D$(L,K)=" " THEN
GOTO 500
 430 IF CODE D$(L,K)>165 THEN GO
TO 2000
 440 IF D$(L,K)="▖" THEN GOTO 22
50
 450 IF D$(L,K)="=" THEN GOTO 25
00
 460 IF D$(L,K)="*" THEN GOTO 27
50
 470 IF D$(L,K)="▄" THEN GOTO 30
00
 480 IF D$(L,K)="▓" THEN GOTO 35
00
 490 IF D$(L,K)="▒" THEN GOTO 37
50
 500 IF INT (RND*250+1)=5 THEN G
OSUB 3250
 510 LET X1=X
 520 LET Y1=Y
 530 NEXT R
 540 LET X2=X
 550 LET Y2=Y
 600 GOTO 4500
1010 FOR R=1 TO 50
1020 NEXT R
1025 GOSUB 6000
1030 PRINT AT 2,1;"BECALMED   YOU
 DRIFT HELPLESS"
1040 PRINT TAB 11;"WHILE YOUR CR
EW"
1050 PRINT TAB 11;"EAT ";CS;S$
1060 GOTO 4500
1205 GOSUB 6000
1210 PRINT AT 2,1;"IN IRONS   YOU
 HAVE SAILED TOO"
1220 PRINT TAB 11;"CLOSE TO THE
WIND."
1230 PRINT TAB 11;"EAT ";CS;S$
1390 GOTO 4500
1410 GOSUB 6000
1420 LET H1=10*(WF-2)
1440 IF WF<12 THEN PRINT AT 2,1;
"STORM    ";
1450 IF WF=12 THEN PRINT AT 2,1;
"HURRICANE ";
1455 PRINT "BATTEN DOWN HATCHES.
"
1460 PRINT AT 3,11;Q$
1470 PRINT TAB 11;H1*(H>H1)+H*(H
<=H1);R$
1480 LET H=(H-H1)*(H>H1)
1490 RETURN
1605 LET D=D-R
1610 IF (N/2<>INT (N/2)) AND (X>
=47.5) THEN GOTO 1700
1620 IF (N/2=INT (N/2)) AND (X<1
.5) THEN GOTO 1725
1630 IF (N<5) AND (Y>=27.5) THEN
 GOTO 1750
1640 IF (N>2) AND (Y<1.5) THEN G
OTO 1775
1645 GOSUB 6000
1650 PRINT AT 2,1;"EDGE OF   CREW
 PERSUADE YOU TO"
1660 PRINT TAB 1;" WORLD   GO NO
 FURTHER. (FLAT"
1670 PRINT TAB 10;"EARTH SOC.MEM
BERS.)"
1672 LET X=X1
1674 LET X2=X1
1676 LET Y=Y1
1678 LET Y2=Y1
1680 GOTO 4500
1700 LET N=N+1
1705 LET Y2=Y1
1710 LET X2=X1-48
1715 LET X1=X2
1720 GOTO 8980
1725 LET N=N-1
1728 LET Y2=Y1
1730 LET X2=X1+48
1735 LET X1=X2
1745 GOTO 8980
1750 LET N=N+2
1755 LET X2=X1
1760 LET Y2=Y1-28
1765 LET Y1=Y2
1770 GOTO 8980
1775 LET N=N-2
1778 LET X2=X1
1780 LET Y2=Y1+28
1785 LET Y1=Y2
1795 GOTO 8980
2010 GOSUB 6000
2020 LET G=G+10*CODE D$(L,K)
2030 PRINT AT 2,1;"TREASURE   YOU
 EXPLORE ASHORE."
2040 PRINT TAB 11;"HERE LIES A C
ASH OF"
2050 PRINT TAB 11;10*CODE D$(L,K
);" GOLD PIECES."
2060 LET Q(CODE D$(L,K)-165)=8
2070 LET D$(L,K)=CHR$ 8
2240 GOTO 4400
2260 GOSUB 6000
2262 LET HL=H
2265 LET H=INT (H*(1-RND/2))-2
2270 PRINT AT 2,1;"ROCKS       ";P
$
2280 PRINT TAB 11;Q$
2290 PRINT TAB 11;HL-H;R$
2310 GOTO 4500
2510 GOSUB 6000
2512 LET HL=H
2515 LET H=INT (H*(1-RND/4))-2
2520 PRINT AT 2,1;"REEF        ";P
$
2530 PRINT TAB 11;Q$
```

```
2540 PRINT TAB 11;HL-H;R$
2560 GOTO 4500
2760 GOSUB 6000
2770 PRINT AT 2,1;"SANDBANK    ";P
$
2780 PRINT TAB 11;"SHIP AGROUND.
"
2790 PRINT TAB 11;"EAT ";CS;S$
2800 GOTO 4500
3010 GOSUB 6000
3012 LET HL=H
3015 LET H=INT (H*(1-RND/2))-2
3020 PRINT AT 2,1;"ICEBERG     ";P
$
3030 PRINT TAB 11;Q$
3040 PRINT TAB 11;HL-H;R$
3060 GOTO 4500
3260 GOSUB 6000
3270 PRINT AT 2,1;"PIRATES     ALL
 YOUR GOLD STOLEN"
3272 LET G=0
3276 LET CS1=CS
3278 LET CS=INT ((CS-1)/(2-RND))
3280 PRINT TAB 11;CS1-CS;" CREWM
EN KILLED."
3286 LET H1=INT ((H-1)/(2-RND))
3290 PRINT TAB 11;H-H1;" PTS. SH
IP DAMAGE."
3292 LET H=H1
3300 FOR R=1 TO 100
3310 NEXT R
3490 RETURN
3505 LET Z=1
3506 GOSUB 4500
3510 GOSUB 6000
3520 PRINT AT 2,1;"HOME      SHIP
ANCHORS SAFELY"
3530 PRINT TAB 1;"PORT      AFTER
";T;" DAYS AT SEA"
3540 PRINT TAB 9;"WITH ";G;" GOL
D PIECES."
3550 IF G>HG THEN GOSUB 3600
3560 GOTO 42
3610 FOR R=1 TO 25
3620 PRINT AT 1,12;"HI-SCORE"
3630 PRINT AT 1,12;"HI-SCORE"
3650 NEXT R
3690 RETURN
3755 LET CS1=CS
3756 GOSUB 6000
3760 LET R=RND
3770 IF R>=.4 THEN GOTO 4000
3780 IF R>=.2 THEN GOTO 3900
3810 LET CS=INT (CS*(1-RND/2))-2
3830 PRINT AT 2,1;"LAND        SAV
AGES ATTACK YOU."
3840 PRINT TAB 11;CS1-CS;" CREWM
EN KILLED."
3850 PRINT TAB 11;"YOU JUST ESCA
PED."
3860 GOTO 4400
3910 LET CS=INT (CS*(1-RND/4))-2
3920 PRINT AT 2,1;"LAND        DUS
KY MAIDENS LURE"
3930 PRINT TAB 11;CS1-CS;" CREWM
EN AWAY..."
3940 PRINT TAB 11;"*LUCKY LADS*"
3950 GOTO 4400
4005 LET Z=1
4006 GOSUB 4500
4010 PRINT AT 2,1;"LAND YOU MAY
TRADE OR SAIL ON."
4020 PRINT TAB 6;"FOOD(F),CREW(C
),REPAIR(R)"
4030 PRINT TAB 6;"SAIL(S).....WH
ICH OPTION?"
4040 IF INKEY$<>"" THEN GOTO 404
0
4042 IF INKEY$="" THEN GOTO 4042
4045 LET T$=INKEY$
4048 GOSUB 6000
4050 IF T$="F" THEN GOTO 4100
4055 IF T$="C" THEN GOTO 4200
4060 IF T$="R" THEN GOTO 4300
4065 IF T$="S" THEN GOTO 4400
4070 GOTO 4000
4075 PRINT AT 3,6;"NOT ENOUGH GO
LD IN HAND."
4080 PRINT AT 10,0;"█     ";AT 10
,1-(G>9999);G
4085 PRINT AT 4,6;"PUSH ANY KEY
TO CONTINUE "
4090 PAUSE 4E4
4095 GOTO 4010
4100 PRINT AT 2,1;"FOOD 1 RATION
 = 1 GOLD PIECE."
4110 PRINT TAB 6;"HOW MANY RATIO
NS?"
4120 INPUT R
4130 IF (G-R)<0 THEN GOTO 4075
4135 IF F+R>2500 THEN PRINT AT 4
,6;"SHIP HOLD TOO SMALL."
4136 IF F+R>2500 THEN GOTO 4120
4140 LET F=F+R
4145 PRINT AT 12,1;"     ";AT 12,
1;F
4150 LET G=G-R
4160 PRINT AT 3,6;R;" RATIONS BO
UGHT."
4170 GOTO 4080
4200 PRINT AT 2,1;"CREW 1 MAN =
10 GOLD PIECES."
4210 PRINT TAB 6;"HOW MANY CREWM
EN?"
4220 INPUT R
4225 IF CS+R>100 THEN PRINT AT 4
,6;"NOT ENOUGH ROOM ON BOARD."
4226 IF CS+R>100 THEN GOTO 4220
4230 IF (G-10*R)<0 THEN GOTO 407
5
4240 LET CS=CS+R
4245 PRINT AT 14,1;"     ";AT 14,
1;CS
4250 LET G=G-10*R
4260 PRINT AT 3,6;R;" CREWMEN TA
KEN ON."
4270 GOTO 4080
4300 PRINT AT 2,1;"REPAIR 20 GOL
D PIECES PER PT."
4310 PRINT TAB 6;"MEND HOW MANY
HARM PTS?"
4320 INPUT R
4325 IF (H+R)>100 THEN GOTO 4320
4330 IF (G-20*R)<0 THEN GOTO 407
5
4340 LET H=H+R
4345 PRINT AT 16,1;"     ";AT 16,
1;100-H
4350 LET G=G-20*R
4360 PRINT AT 3,6;R;" HARM PTS.
MENDED.     "
4370 GOTO 4080
4410 PRINT AT 5+L,5+K;D$(L,K)
4420 LET X2=X1
4425 LET X=X1
4430 LET Y2=Y1
4435 LET Y=Y1
4440 PLOT X2+12,Y2+2
4450 LET Z=0
4510 FOR R=8 TO 16 STEP 2
4520 PRINT AT R,0;"█         "
4530 NEXT R
4540 PRINT AT 8,1;T;AT 10,1-(G>9
999);G;AT 12,1;F;AT 14,1;CS;AT 1
6,1;100-H
4550 IF Z=1 THEN RETURN
4760 IF H<5 THEN GOTO 5750
4770 IF CS<10 AND D$(L,K)=" " TH
```

```
EN GOTO 5500
4780 IF CS<10 THEN GOTO 5250
4790 IF F=0 THEN GOTO 5000
4820 GOTO 100
5005 GOSUB 6000
5010 PRINT AT 2,1;"MUTINY      THE
 HUNGRY CREW TAKE"
5020 PRINT TAB 11;"OVER YOUR SHI
P AND"
5030 PRINT TAB 11;"YOU WALK THE
PLANK."
5040 GOTO 42
5255 GOSUB 6000
5260 PRINT AT 2,1;"MAROONED   INS
UFFICIENT CREW."
5270 PRINT TAB 11;"LIKE ROBINSON
 CRUSOE"
5280 PRINT TAB 11;"YOU ARE HIGH
AND DRY"
5290 GOTO 42
5505 GOSUB 6000
5510 PRINT AT 2,1;"ADRIFT      INS
UFFICIENT CREW TO"
5520 PRINT TAB 11;"SAIL THE SHIP
.THIRST"
5530 PRINT TAB 11;"AND HUNGER SE
T IN..."
5540 GOTO 42
5755 GOSUB 6000
5760 PRINT AT 2,1;"ABANDON    TOO
 MUCH DAMAGE-SHIP"
5770 PRINT TAB 2;"SHIP       START
S TO LIST-WATER"
5780 PRINT TAB 11;"GUSHES IN-SHI
P SINKS"
5790 GOTO 42
6010 FOR R=1 TO 4
6020 PRINT AT R,1;"

6030 NEXT R
6040 LET X2=X
6050 LET Y2=Y
6060 RETURN
6110 FOR R=1 TO 15
6120 PRINT AT 5+R,6;D$(R)
6130 NEXT R
6140 RETURN
7260 LET D$(1)="
     "
7265 LET D$(2)="
     "+CHR$ Q(4)+" "
7270 LET D$(3)="
"+CHR$ Q(3)+"
7275 LET D$(4)="
 
7280 LET D$(5)="     ==  ==
 
7285 LET D$(6)="   ==      ==
 
7290 LET D$(7)="   ==    ==
 
7295 LET D$(8)="   ==  "+CHR$ Q(
1)+"  ==
7300 LET D$(9)="    ===  ==
 
7305 LET D$(10)="=    =====
 =
7310 LET D$(11)="==
    "+CHR$ Q(2)+"  "
7315 LET D$(12)="  ==       =
 
7320 LET D$(13)="     ***  =
      *
7325 LET D$(14)="     ***  ==
      *"
7330 LET D$(15)="          ===
      **"
7420 GOSUB VAL "6100"
7450 RETURN
7510 LET D$(1)="
       "
7515 LET D$(2)="
 
7520 LET D$(3)="   "+CHR$ Q(6)+
"
7525 LET D$(4)="
 
7530 LET D$(5)="
 
7535 LET D$(6)="
 
7540 LET D$(7)="          "+CH
R$ Q(7)+"
7545 LET D$(8)="
 
7550 LET D$(9)="  "+CHR$ Q(5)+"
 
7555 LET D$(10)="
 
7560 LET D$(11)="
 
7565 LET D$(12)="
       "
7570 LET D$(13)="*
  "+CHR$ Q(8)+"    "
7575 LET D$(14)="*
 
7580 LET D$(15)="**
  "+CHR$ Q(9)+"    "
7620 GOSUB VAL "6100"
7650 RETURN
7760 LET D$(1)="
 
7765 LET D$(2)="
 
7770 LET D$(3)="
 
7775 LET D$(4)="
 
7780 LET D$(5)="
 
7785 LET D$(6)="
 
7790 LET D$(7)="          ***
 
7795 LET D$(8)="   "+CHR$ Q(12)
+"     **
7800 LET D$(9)="          *
**
7805 LET D$(10)="          *  "
+CHR$ Q(13)+"**
7810 LET D$(11)="    "+CHR$ Q(11
)+"     ****
7815 LET D$(12)="         **
*
7820 LET D$(13)="
 
7825 LET D$(14)="   "+CHR$ Q(1
0)+"
7830 LET D$(15)="
     "
7920 GOSUB VAL "6100"
7950 RETURN
8010 LET D$(1)="        **** *
 **
8015 LET D$(2)="        *****"+
CHR$ Q(17)+"*  ***  *"
8020 LET D$(3)="         ****
 **    **"
8025 LET D$(4)="         ***
  ****"
8030 LET D$(5)="          **
 *******"
8035 LET D$(6)="       **
      **"
8040 LET D$(7)="
****     *"
8045 LET D$(8)="   "+CHR$ Q(1
```

```
5)+"▒▝          **** *    *"
8050 LET D$(9)="  ▒▒▒       ▒▒▒      *
 *   *   "
8055 LET D$(10)="▒▒▒      ▒▒▒▒       *
 "+CHR$ Q(16)+"     =      "
8060 LET D$(11)="▒▒▒     ▒▒▒▒        =
    =
8065 LET D$(12)="  "+CHR$ Q(14)+"
▒ ▝          == ==  =        "
8070 LET D$(13)="  ▒▒          ▝
==   == =      "
8075 LET D$(14)="▒▒▒▝       ▒▒▝
   ==       "
8080 LET D$(15)="▒▒▒        ▒▒▝
  ▀      ▀"
8200 GOSUB VAL "6100"
8240 RETURN
8260 LET D$(1)="▒▒▒            ▞▞
   **   "
8265 LET D$(2)="▒▒▒▒ ▀         ▞▞   ▝
   ***"
8270 LET D$(3)="     ▒▒"+CHR$ Q(18)
+"  ▀     ▝         ****"
8275 LET D$(4)="        ▒
   *    "
8280 LET D$(5)="  ▀    ▀           ▞▞
 "
8285 LET D$(6)="        ▀          ▒
▒  ▒▒        "
8290 LET D$(7)="            ▝      ▒
▒▒▒▒▒▒▒   ▒"
8295 LET D$(8)="  ▀         ▒▒▒   ▒
▒ ▒       ▒"
8300 LET D$(9)="         ▀      ▒▒▒▒"
+CHR$ Q(19)+"▒      ▒▒
8305 LET D$(10)="       ▀          ▒▒
▒"+CHR$ Q(20)+"     ▒        "
8310 LET D$(11)="                  ▒
▒▒▒▒▒▒▒▒   ▒▒"
8315 LET D$(12)="
▒▒▒▒▒"+CHR$ Q(22)+"▒▒▒▒▒▒"
8320 LET D$(13)="          █       ▒
▒▒  "+CHR$ Q(21)+"▒▒▒▒▒▒▒"
8325 LET D$(14)="                 ▒▒
▒   ▒▒▒▒"+CHR$ Q(23)+"  "
8330 LET D$(15)="                 ▒▒
▒   ▒▒▒▒▒"
8420 GOSUB VAL "6100"
8450 RETURN
8510 LET D$(1)="        ▒▒▒▒▒      ==
 == ▣"
8515 LET D$(2)="*        ▒▒▒      ==
 "
8520 LET D$(3)="*                 ==
 --   "
8525 LET D$(4)="          ▒▒▒    == =
=="+CHR$ Q(26)+"==           "
8530 LET D$(5)="          ▒      ==
 ==    ="
8535 LET D$(6)="  ▒▒▞▞    ▒      ==
 ==   ==="
8540 LET D$(7)="▒▒▒▒"+CHR$ Q(24)+
"▝  ▒▒     === ==  ===="
8545 LET D$(8)="▒   ▒▒▒     ▒
 ==  ==   "
8547 LET D$(9)="    ▒▒▒     ▒     ==
==="
8550 LET D$(10)="  ▒▒▒▝    ▞▒▝     =
==▒▒==       "
8555 LET D$(11)="▒▒▒▒▒▒        "+CHR$
Q(25)+"          ==      "
8560 LET D$(12)="▒▒▒▒▒       ▝ ▝
   ==   "
8565 LET D$(13)="▒▒▒▒▒      ▝  ▝   **
****      "
8570 LET D$(14)="     ▞▞         ***
   **   "
8575 LET D$(15)="▒    ▞▞        ****
*  **   "
8600 GOSUB VAL "6100"
8740 RETURN
8755 CLS
8760 PRINT "▒VOYAGE OF PERIL - B
Y N.BROOKS▒"
8770 FOR R=1 TO 4
8780 PRINT "█";TAB 31;"█"
8790 NEXT R
8810 PRINT "▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀
▀▀▀▀▀▀"
8820 FOR R=1 TO 15
8830 PRINT "▒▒▒▒█";TAB 31;"▒"
8840 NEXT R
8850 PRINT "▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒
▒▒▒MAP 1▒▒▒"
8860 PRINT AT 6,0;"▒STATUS▒";AT 7,
1;"DAYS";AT 8,0;"█0     "
8870 PRINT AT 9,1;"GOLD";AT 10,0
;"█1000█";AT 11,1;"FOOD";AT 12,0
;"█2500█"
8880 PRINT AT 13,1;"CREW";AT 14,
0;"█100  █";AT 15,1;"HARM";AT 16,
0;"█0    █"
8890 PRINT AT 17,0;"  ▛▀▀▀▜  ";AT 18
,0;"█ N  █";AT 19,0;"█ W+E █";AT 20
,0;"█ S  █";AT 21,0;"  ▙▄▄▄▟  "
8980 GOSUB (7000+250*N)
8985 PRINT AT 21,29;CHR$ (N+156)
8990 IF T>0 THEN GOTO 330
8992 PLOT X+12,Y+2
8994 GOTO 100
9510 PRINT TAB 1;"VOYAGE OF PERI
L - BY N.BROOKS."
9520 PRINT ,,"INSTRUCTIONS:-"
9530 PRINT " YOU ARE CAPTAIN OF
HMS BOUNTY  AT ANCHOR IN THE BOT
TOM LEFTHANDCORNER OF MAP 1."
9540 PRINT " YOUR OBJECTIVE IS T
O SAIL WITH AS MUCH GOLD AS POSS
IBLE,TO YOURHOME PORT (SHOWN AS
▣ ON MAP 6),BY SETTING A SUITABL
E COURSE ANDSAIL AREA AGAINST TH
E WIND WHILENAVIGATING AROUND HA
ZZARDS."
9550 PRINT " PREPARE FOR ATTACK
BY PIRATES  AND SAVAGES."
9560 PRINT " EACH CREWMAN EATS 1
 FOOD RATIONPER DAY BUT YOU MAY
BUY FOOD,   REPAIR DAMAGE AND TA
KE ON CREW  WHEN YOU LAND, IF GO
LD PERMITS."
9570 PRINT " YOU WILL FIND MORE
GOLD AT THE TREASURE POINTS MARK
ED ▣ TO ▣."
9580 PRINT TAB 10;"*GOOD LUCK*"
9740 RETURN
9760 LET CS=100
9770 LET N=1
9780 DIM D$(15,25)
9800 LET H=100
9810 LET G=1000
9820 LET F=2500
9830 LET X1=0
9840 LET Y1=0
9850 LET X=1
9860 LET Y=1
9870 LET T=0
9880 LET L=15
9890 LET K=1
9900 DIM Q(26)
9910 FOR R=1 TO 26
9920 LET Q(R)=165+R
9930 NEXT R
9940 LET P$="BAD NAVIGATION."
9950 LET Q$="SHIP DAMAGE OF"
9960 LET R$=" PTS SUSTAINED."
9970 LET S$=" FOOD RATIONS"
9980 LET Z=0
9990 RETURN
```

Building An Adventure Brain

3: The final stages by Brian J. Robb.



Through the first two articles in this series I have shown you how to build a sample adventure game system to use in writing your own BASIC adventures. The examples in those two articles combine to give you the bare bones of an adventure game. The structure has been left simple enough for you to make your own additions and alterations and to produce your own personal adventure. Figure 9 which accompanied the previous article lays out the structure of the program and so allows you to position your own routines to enable them to work efficiently.

In this article, the last in the series, I will cover what can be considered as one of the most important parts of a successful adventure — the individual subroutines which go to make up the events within the adventure. So far, you have the bare bones of the adventure, but it is necessary to build upon this, and provide the meat — the individual subroutines.

In the program examples accompanying this series I have provided the minimum examples needed in order to leave you to create your own scenario. In this article however, I shall adopt a basic scenario of, say, exploring a castle, although all the routines will be general enough to adapt them to any scenario you may wish to base your adventure on.

The first of these general subroutines concerns doors, whether they are open or not and keys, defined as objects. The player while wandering around the castle may come across several doors and the computer must be able to inform the player of their condition — open or shut.

At the area of the program



where the locations are stored, those with doors, either open or closed must have an extra line added. An array, with the same number of elements as locations (for example I'll just use ten for simplicity), should be set up. In this example I shall use D(10). Each element corresponding to each location should either be set at 1, to signify the fact that the door is open, or set at 0, to show that the door is locked. Once this has been added to each location with a door (those without doors can be ignored, the array need only have enough elements for those locations with doors), then a piece of code has to be written so that when the player comes across a room with a door the player can inform him whether it is open or locked. Figure 1 shows this short routine for both the ZX81 and Spectrum. Also included is a line, assuming the key to be object number 7 (easily altered to fit your own numbering scheme), which allows the computer to inform the player whether or not he has a key. The variable, L, is the present location number. This routine, in Figure 1, is easily adaptable to suit your own adventure scenario, whether it be space ship doors or house doors.

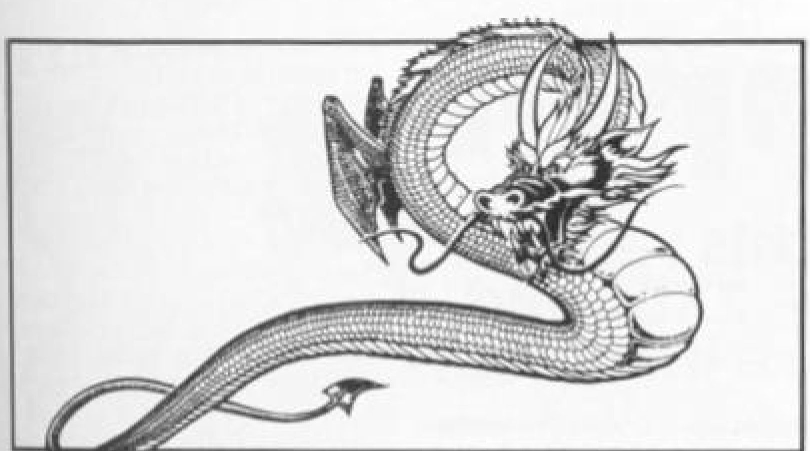
Creatures

An essential part of an adventure program are the creatures and monster the player shall meet, and the combat routine. First it is necessary to define your creatures, in the same way that the verbs and objects were defined. Figure 2 shows the necessary program lines. M$ is the variable used to hold the creature's name, and the numbers in brackets should correspond to the location where it will be found. The variable P stands for power and represents the creature's strength. The player must also have a strength value defined at the beginning of the program. For example 'LET PLPOW=45', where PLPOW stands for 'PLayer POWer'. It is often a good idea, when your program contains many variables, to give each one an individual and distinct name so that you can recognise what each one represents, as it is often easy to get lost. The strength values of both the creatures and the player come into play in the conflict routine.

The adventurer who is searching the castle is armed with a broad sword, and so is able to fight the various creatures he may meet. It is usually necessary to kill a particular creature before you can enter a particular location. Figure 3 lists the program lines which comprise the basic combat routine, which is of course, simple enough for you to understand and alter to your own needs. The first line of the program prints on screen the player's and monster's current strength values, and these will alter as the combat progresses. The variable LUCK will be a number between 1 and 10, and is there to prevent the strongest of the two automatically winning.

If the luck factor is between one and five, then the player gets the first strike, if it is between six and ten, then the creature strikes first. The strength values of the creature and the player are reduced by the random luck value generated. The odds, therefore, are slightly in favour of the player as, if the luck value is high, the monster is wounded and so a larger number is subtracted. After each round of combat the player is given a chance to retreat, in order to recover and fight another day. The strength values are reprinted after each round of combat. This is only one example of a combat routine and has deliberately kept simple. Much more complicated and sophisticated combat routines can be devised, but those are beyond the scope of this series of article.

In this last few issues, I have tried to provide an alternative to the current generation of 'Quilled' adventure games. Home computer owners can now churn out formularised games for their own amusement, and software houses have swamped the market with games composed on the Quill but there are still those of us that like to write our own games from scratch, code and all. This is why the program examples included with this series have been fairly sparse. The idea is for you to use the ideas and methods explained throughout the series to write your own adventure games. Undoubtedly the Quill adventure writer has been a blessing to those that don't wish to learn BASIC, but for those who already know a little BASIC, the Quill might actually have stifled their creativeness, as it is easier than trying to figure out a way to write an adventure game from scratch. I hope that these articles may have rekindled the creativeness and produce new interest among programmers to write their games without the aid of programmers to write their games without the aid of programs such as the Quill. By giving some examples of routines fundamental to adventure game writing, I hope to have helped both those stuck with problems and those too perplexed to start. Hopefully, articles such as this will stimulate people to send their home written computer adventures to the program pages of magazines such as *ZX Computing*, and show people that not all adventures are written by the Quill. After all, without people to write adventures from scratch the Quill wouldn't exist.



```
1100 REM FIGURE 2 MONSTERS
1110 FOR m=1 TO 5: READ m$,p: NE
XT m
1120 DATA "wolf",10,"goblin",15,
"dwarf",25,"orc",50,"giant",100
```

```
1000 REM ARTICLE 3
1010 REM FIGURE 1 DOORS
1020 FOR n=1 TO 10
1030 IF d(1)=1 THEN  PRINT "an o
pen door"
1040 IF d(1)<>1 THEN  PRINT "a l
ocked door"
1050 IF o(7)=-1 AND d(1)=1 THEN
 PRINT "you have a key"
1060 IF o(7)=-1 AND d(1)=1 THEN
 PRINT "you have no key"
1070 NEXT n
```

```
1200 REM FIGURE 3 COMBAT
1210 PRINT m$(x);p(x);" :: ";"yo
u";plpow
1220 INPUT "do you give up?(y/n)
";z$
1230 IF z$="y" THEN  GO TO x
1235 REM x=main prog
1240 LET luck=(RND*10)+1
1250 IF luck<=5 THEN  LET q=1
1260 IF luck>=6 THEN  LET q=2
1270 IF q=2 THEN  GO TO 1300
1280 LET p=p-luck
1290 GO TO 1210
1300 LET plpow=plpow-luck
1310 GO TO 1210
```

These routines are the same for both ZX81 and Spectrum, except that all Letters will be in upper case on the ZX81.

Two From Cheetah



I seem to be spending a lot of time these days reviewing joystick interfaces, and just to add to their numbers Cheetah have launched another Kempston compatible joystick of their own.

It's hard to know what to say about it really — it does the job as well as most other interfaces, and though it's a fairly basic no-frills effort it's not as expensive as others on the market. It could have been a little more robustly made, I think, but on the other hand it does fit into the Spectrum's rear port nice and snuggly, without wobbling and putting any strain on the edge connector (that being one of my pet hates in a number of interfaces of all sorts).

Perhaps a more interesting product is the Mega-Sound unit that Cheetah have also produced. Housed in a case of the same design as the joystick interface, this plugs into the Spectrum's rear port and also has a small plug which fits into the MIC socket. Then, once it has been tuned properly, the Mega-Sound boosts the Spectrum's feeble BEEP through your television speaker, making it sound much more impressive than usual, albeit a bit screechy at times.

The fine tuning is performed via a small hole in the front of the Mega-Sound's case and a small, plastic 'screw driver' is provided for the purpose. The hole, though, is so low that the Spectrum keyboard gets in the way and makes the tuning process rather fiddly.

The through edge connector at the rear of the Mega-Sound unit is a good idea of course, allowing you to use additional add-ons, however despite Cheetah's claims that the Mega-Sound is compatible with all other Cheetah's peripherals, when I plugged the joystick interface into its through port, the two units fit so close together that there was no room for the joystick socket to be plugged in. Not terribly compatible in other words.

Joystick Interface £11.50 (£12.75 with through connectors.
Mega-Sound £10.95
Cheetah Marketing Ltd, 24 Ray St, London Ec1.

Chart Topper

Mike Hyams returns with this record breaking strategy game. — ZX81 and Spectrum conversion tips are included.



Most people imagine themselves as pop stars at some time or other, but the more mercenary of us imagine ourselves as pop star managers! I don't know if Mike was ever in the business but it seems very realistic when compared to my own experiences.

Playing The Game

Be careful not to spend more than you have as this incurs instant dismissal!

When booking you may book for any week of the year provided you have the cash in hand at that time, however the one exception is the pub or club hall booking which is paid for on the actual night. Once the band has given the minimum amount of performances you can then release a record, single or album. However, if you are not under contract to a record label then you will get no revenue from them.

During the group's initial build-up of its following there may be offers from unscrupulous companies who will try to tie you up for two or three years at a low percentage. This could cause the loss of a lot of money if the band's career suddenly takes off!

It is very unlikely that the first record releases will get into the charts, in fact they will probably flop. On the other hand, should you achieve mega-stardom then a Number One is on the cards.

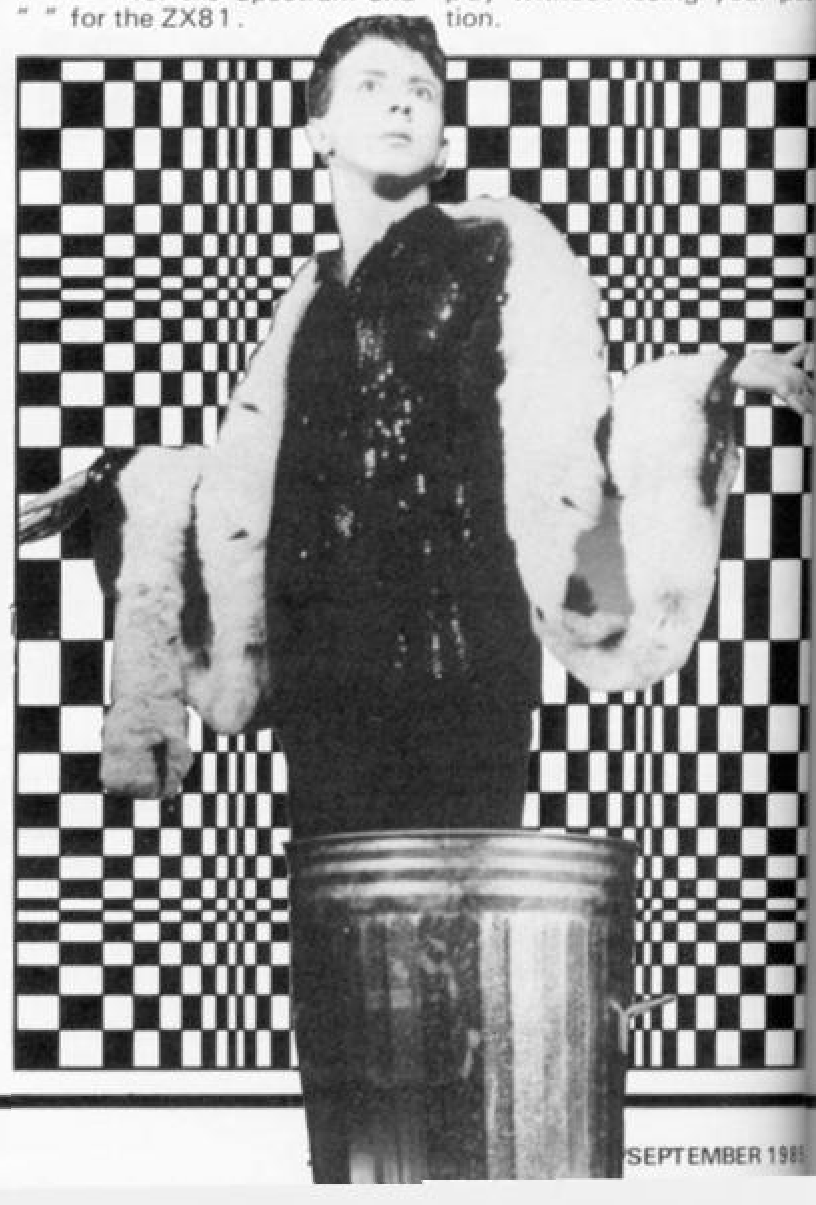
Conversion Hints

ZX81/SPECTRUM:
Replace all CHR$(212) with " " " " for the Spectrum and " " for the ZX81.
Replace all **RND(no)** wi[th] **INT(RND ✱ no) + 1)**.
Replace **TL$** in line 1280, 130[0] with **B$(2 TO)**.
Change Line 720 t[o] SAVE"chart" and add, **73[0]** **GOTO 95**.

Spectrum only:
Add 30000 to all number[s] 31000 + in the following line[s] 655, 679, 1240, 1645, 1840, 1920, 5121, 5122, 5360, 5435, 5501, 5511.
Replace all **CHR$ (128)** with th[e] inverse space on Graphics ke[y] 8.
Change the number 3584 in lin[e] 1500 to 15360.
Replace the number 14 in line[s] 1273, 1276, 1293 and 129[8] with 58.
Change line 720 to **SAV[E]** **"chart" LINE 95**.

There are almost certainly one o[r] two other changes to be mad[e] which have slipped by our eagl[e] eyes, I'm sure you'll let us know so we can pass them on to othe[r] readers.

IMPORTANT — When th[e] program is saved from the op[-]tion offered on Mondays, the[n] on subsequent reloadings star[t] the program by **GOTO 95**, thi[s] will restart the program shoul[d] you accidently break out durin[g] play without losing your pos[i]tion.



Line Breakdown

110-231	Print the cash amount.
235-950	Monday options.
1000-1991	Tuesday chart routines.
1265-1590	Print chart position in large lettering.
1810-1950	Calculate chart position for the next week.
2000-2730	Wednesday, booking routines.
3000-3560	Thursday, current week bookings carried out, results.
5000-5580	End of week report.
6010-6200	Subroutine to print current booking schedule.
9000-9400	Initialisation of program.
9500-9570	Prints group name in inverse graphics.
9450-9459	Subtraction routine.
9640-9469	Addition routine.


The Shangri-Las


The Shirelles

```
   1 RANDOMISE
  10 GO SUB 9000
  95 FOR N=1 TO 5
  96 LET S(N)=0
  97 NEXT N
 100 GO SUB 9500
 105 PRINT "MONDAY      WEEK  ";WEEK
;"  ";YEAR
 107 GO TO 235
 110 PRINT "MONEY = £";
 120 IF CASH3>0 THEN PRINT CASH3
;
 130 LET CASH=CASH2
 140 IF CASH3>0 THEN GO SUB 150
 141 IF CASH3=0 AND CASH2>0 THEN
 PRINT CASH2;
 145 GO TO 200
 150 IF CASH=0 THEN PRINT "000";
 160 IF CASH>0 AND CASH<10 THEN
PRINT "00";CASH;
 170 IF CASH>9 AND CASH<100 THEN
 PRINT "0";CASH;
 180 IF CASH>99 THEN PRINT CASH;
 190 RETURN
 200 LET CASH=CASH1
 210 IF CASH3>0 OR CASH2>0 THEN
GO SUB 150
 220 IF CASH3=0 AND CASH2=0 THEN
 PRINT CASH1
 230 PRINT
 231 RETURN
 235 PRINT
 236 GO SUB 110
 240 PRINT " DO YOU WANT TO ARRA
NGE....."
 245 PRINT
 250 PRINT ,"1) ADVERTISING"
 260 PRINT
 270 PRINT ,"2) A RECORDING CONT
RACT"
 280 PRINT
 310 PRINT ,"3) A RECORD RELEASE
"
 320 PRINT
 330 PRINT ,"4) SAVE TO TAPE"
 340 PRINT
 341 PRINT ,"5) NOTHING"
 342 PRINT
 350 PRINT "PLEASE CHOOSE ONE OF
 THE ABOVE"
 360 INPUT A
 370 IF A>5 OR A<1 THEN GO TO 36
0
 375 IF S(A)=1 THEN GO TO 360
 376 LET S(A)=1
 390 GO TO A*100+300
 400 CLS
 401 PRINT ,"ADVERTISING"
 402 PRINT "ITEM
     COST"
 404 PRINT
 405 PRINT "1. LEAFLETS",,"£50"
 406 PRINT
 407 PRINT "2. MUSIC PAPERS",,"£
200"
 408 PRINT
 409 PRINT "3. MUSIC PAPERS",,"£
1000"
 410 PRINT
 411 PRINT "4. STREET POSTERS","
£500"
 412 PRINT
 413 PRINT "5. STREET POSTERS","
£2000"
 414 PRINT
 415 PRINT "6. RADIO",,"£3000"
 416 PRINT
 417 PRINT "7. T.V.",,,"£10000"
 418 PRINT
 419 PRINT "8. NOTHING",,"£0"
 420 PRINT
 421 GO SUB 110
 422 PRINT "PLEASE SELECT YOUR C
HOICE"
 423 INPUT A
 424 IF A<1 OR A>8 THEN GO TO 42
```

▶

```
3
 425 IF A=8 THEN GO TO 100
 426 GO TO A*10+420
 431 LET CASH1=CASH1-50
 432 GO SUB 9450
 433 LET FANS=FANS+RND(10000-FAN
S)/1000
 439 GO TO 100
 441 LET CASH1=CASH1-200
 442 GO SUB 9450
 443 LET FANS=FANS+RND(10000-FAN
S)/500
 449 GO TO 100
 451 LET CASH2=CASH2-1
 452 GO SUB 9450
 453 LET FANS=FANS+RND(10000-FAN
S)/200
 459 GO TO 100
 461 LET CASH1=CASH1-500
 462 GO SUB 9450
 463 LET FANS=FANS+RND(10000-FAN
S)/200
 469 GO TO 100
 471 LET CASH2=CASH2-2
 472 GO SUB 9450
 473 LET FANS=FANS+RND(10000-FAN
S)/100
 479 GO TO 100
 481 LET CASH2=CASH2-3
 482 GO SUB 9450
 483 LET FANS=FANS+RND(10000-FAN
S)/50
 489 GO TO 100
 491 LET CASH2=CASH2-10
 492 GO SUB 9450
 493 LET FANS=FANS+RND(10000-FAN
S)/30
 499 GO TO 100
 500 CLS
 510 PRINT "RECORDING CONTRACTS
REVIEW"
 520 PRINT "▒▒▒▒▒▒▒▒▒ ▒▒▒▒▒▒▒▒
▒▒▒▒"
 530 PRINT
 531 IF TIME=0 THEN GO TO 540
 532 PRINT "YOUR CONTRACT WITH "
;C$
 533 PRINT "STILL HAS ";TIME;" W
EEKS TO RUN."
 534 GO TO 554
 540 IF FANS>1000 THEN GO TO 560
 545 PRINT "NOBODY WANTS TO PUT
YOUR GROUP"
 546 PRINT
 548 PRINT "UNDER CONTRACT BECAU
SE THEY DO"
 550 PRINT
 551 PRINT "NOT HAVE A BIG ENOUG
H FOLLOWING."
 554 PRINT
 555 PRINT
 556 GO SUB 9605
 558 GO TO 100
 560 LET A=RND(6)
 561 GO TO 560+A*2
 562 LET C$="E.M.I."
 563 GO TO 573
 564 LET C$="VIRGIN"
 565 GO TO 573
 566 LET C$="C.B.S."
 567 GO TO 573
 568 LET C$="ARISTA"
 569 GO TO 573
 570 LET C$="EPIC"
 571 GO TO 573
 572 LET C$="A + M"
 573 PRINT "YOU HAVE BEEN OFFERE
D A CONTRACTBY ";C$;" RECORDS."
 574 PRINT
 575 PRINT "THE OFFER IS AS FOL
OWS..."
 576 PRINT
 577 LET PER=RND(FANS/1000)
 578 PRINT "ROYALTIES AT ";PER;
PERCENT"
 579 PRINT "PER SALE."
 580 PRINT
 581 PRINT ,"OR"
 582 PRINT
 583 LET FLAT=RND(FANS/10)+1000
 584 PRINT "A FLAT RATE OF £";F
AT;" PER"
 585 PRINT "SINGLE AND £";FLAT*
;" PER ALBUM"
 586 PRINT
 587 LET TIME=RND(3)*52
 588 PRINT "PERIOD OF CONTRACT
S ";TIME/52;" YEARS"
 590 PRINT
 591 PRINT "DO YOU WANT (R)OYAL
Y,",,"(F)LAT RATE, OR (N)IETHER
?"
 592 INPUT B$
 593 IF NOT B$="R" AND NOT B$="
" AND NOT B$="N" THEN GO TO 592
 594 IF B$="N" THEN LET TIME=0
 595 IF B$="N" THEN GO TO 100
 595 IF B$="R" THEN LET FLAT=0
 597 IF B$="F" THEN LET PER=0
 599 GO TO 100
 600 CLS
 605 PRINT ,"RECORD RELEASE"
 606 PRINT ,"▒▒▒▒▒▒ ▒▒▒▒▒▒▒"
 610 PRINT
 613 PRINT "(S)INGLE OR (A)LBUM
?"
 614 PRINT
 615 INPUT B$
 616 IF B$="S" OR B$="A" THEN G
TO 620
 617 GO TO 615
 620 IF (B$="S" AND ALBUM>0 AND
CULL<5) OR (B$="S" AND REC>3) O
 (B$="A" AND REC>19) THEN GO TO
639
 621 IF B$="A" THEN LET B$="AN
LBUM"
 622 IF B$="S" THEN LET B$="A S
NGLE"
 623 PRINT "YOU MUST DO MORE RE
ORDING",,,,,"BEFORE YOU CAN REL
ASE ";B$
 624 PRINT
 625 PRINT
 626 PRINT "RECOMMENDED MINIMUM
..."
 627 PRINT
 628 PRINT "SINGLE - 4 SESSIONS
 629 PRINT
 630 PRINT "ALBUM  - 20 SESSION
"
 632 PRINT
 634 PRINT "NO MORE THAN 4 SING
ES FROM 1 LP"
 638 GO TO 554
 639 LET P$=""
 540 IF B$="A" THEN GO TO 669
 641 FOR A=1 TO 5
 642 IF Z(A)=0 THEN GO TO 645
 643 NEXT A
 644 GO TO 695
 645 IF ALBUM<1 THEN GO TO 649
 646 PRINT "IS THIS SINGLE FROM
THE ALBUM     ";CHR$(212);Y$;CHR$
212);"    Y/N"
 647 INPUT P$
 648 IF P$="Y" AND CULL>3 THEN G
O TO 695
 649 PRINT "NAME OF NEW SINGLE
"
```

```
650 INPUT B$
651 LET Z$=B$
652 LET Z(A)=999
653 LET SINGLE=SINGLE+1
654 LET X(A)=SINGLE
655 LET LOOP=31475+X(A)*25
656 FOR A=LOOP TO LOOP+19
657 POKE A,CODE(B$)
658 LET B$=TL$(B$)
659 NEXT A
660 PRINT
661 PRINT CHR$(212);Z$;CHR$(212
)
662 PRINT
663 PRINT "WILL BE RELEASED ON
THURSDAY"
665 IF P$="N" OR P$="" THEN GO
SUB 9700
666 IF P$="Y" THEN LET CULL=CUL
L+1
667 GO TO 554
669 FOR A=1 TO 5
670 IF Y(A)=0 THEN GO TO 673
671 NEXT A
672 GO TO 695
673 LET Y(A)=999
674 PRINT "NAME OF ALBUM ?"
675 LET ALBUM=ALBUM+1
676 INPUT B$
677 LET Y$=B$
678 LET W(A)=ALBUM
679 LET LOOP=31975+W(A)*25
680 FOR A=LOOP TO LOOP+19
681 POKE A,CODE(B$)
682 LET B$=TL$(B$)
683 NEXT A
684 PRINT
685 PRINT "HOW MANY OF YOUR REC
ORDINGS TO  BE USED ON THIS ALBU
M ?"
686 INPUT REC1
687 IF REC1<20 OR REC1>REC THEN
GO TO 686
688 PRINT
689 PRINT CHR$(212);Y$;CHR$(212
)
690 PRINT
691 PRINT "WILL BE RELEASED ON
WEDNESDAY."
692 LET REC=REC-REC1
693 LET CULL=0
694 GO TO 554
695 PRINT "NO MORE THAN 5 SINGL
ES AND          5 ALBUMS MAY BE ON R
ELEASE AT      THE SAME TIME."
697 GO TO 554
700 PRINT "START TAPE AND PRESS
N/L"
710 INPUT B$
720 SAVE
810 IF TIME=0 THEN GO TO 1000
820 IF PER=0 THEN GO TO 900
830 FOR Z=1 TO 5
840 IF Z(Z)>150 OR Z(Z)=0 THEN
GO TO 850
841 LET CASH1=CASH1+(151-Z(Z))*
PER
842 GO SUB 9460
850 IF Y(Z)>150 OR Y(Z)=0 THEN
GO TO 860
852 LET CASH1=CASH1+(151-Y(Z))*
PER*5
853 GO SUB 9460
860 NEXT Z
870 GO TO 1000
900 FOR Z=1 TO 5
910 IF Z(Z)=999 THEN LET CASH1=
CASH1+FLAT
920 GO SUB 9460
930 IF NOT Y(Z)=999 THEN GO TO
950
935 FOR B=1 TO 5
936 LET CASH1=CASH1+FLAT
937 GO SUB 9460
938 NEXT B
950 NEXT Z
1000 GO SUB 9600
1010 GO SUB 9500
1020 PRINT "TUESDAY    WEEK ";WEE
K;"   ";YEAR
1030 PRINT
1040 PRINT "CHART DAY"
1050 PRINT "--------- ---"
1060 FOR A=1 TO 5
1063 IF Z(A)=0 OR Z(A)=999 THEN
GO TO 1065
1064 GO TO 1190
1065 IF Y(A)=0 OR Y(A)=999 THEN
GO TO 1067
1066 GO TO 1190
1067 NEXT A
1070 PRINT "YOU DO NOT HAVE ANY
RECORDS"
1080 PRINT
1090 PRINT "ON THE CHART AT THE
MOMENT."
1095 GO TO 1310
1190 PRINT "PRESS N/L FOR NEW CH
ART"
1191 PRINT
1195 INPUT B$
1210 FOR Z=1 TO 5
1211 CLS
1215 IF Z(Z)=0 OR Z(Z)>100 THEN
GO TO 1259
1221 PRINT "BBC/GALLUP SINGLES C
HART"
1226 PRINT
1230 GO SUB 9505
1236 PRINT "SINGLE :- ";
1240 LET D=X(Z)*25+31475
1241 FOR A=D TO D+19
1242 PRINT CHR$(PEEK(A));
1243 NEXT A
1244 PRINT
1245 LET AA=A
1246 PRINT "WEEKS IN CHART =  ";P
EEK(A)
1247 PRINT "HIGHEST POSITION =";
PEEK(A+1),,"LAST WEEK =  ";PEEK(A
+2)
1248 PRINT
1249 PRINT "PRESS N/L FOR NEW PO
SITION"
1250 INPUT B$
1251 PRINT
1252 LET QQ=Z(Z)
1253 GO SUB 1265
1254 PRINT "PRESS N/L"
1255 INPUT B$
1256 POKE AA+2,Z(Z)
1257 POKE AA,PEEK(AA)+1
1258 IF Z(Z)<PEEK(AA+1) OR PEEK(
AA+1)=0 THEN POKE (AA+1),Z(Z)
1259 NEXT Z
1260 GO TO 1600
1265 LET B$=STR$(QQ)
1270 LET A=CODE(B$)
1273 IF QQ<100 THEN LET A=14
1276 IF A=14 THEN GO TO 1290
1280 LET B$=TL$(B$)
1290 LET B=CODE(B$)
1293 IF QQ<10 THEN LET B=14
1296 IF B=14 THEN GO TO 1310
1300 LET B$=TL$(B$)
1310 LET C=CODE(B$)
1320 FOR D=0 TO 7
1330 LET NUM=A
1340 GO SUB 1500
1350 LET NUM=B
1360 GO SUB 1500
1370 LET NUM=C
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1380 GO SUB 1500
1385 PRINT
1390 NEXT D
1400 RETURN
1500 LET NUM=NUM*8+3584+D
1510 LET NUM=PEEK(NUM)
1515 LET DIV=128
1520 FOR E=1 TO 8
1530 IF NUM>DIV-1 THEN GO TO 1550
1540 PRINT " ";
1545 GO TO 1570
1550 PRINT CHR$(128);
1560 LET NUM=NUM-DIV
1570 LET DIV=DIV/2
1580 NEXT E
1590 RETURN
1600 FOR Z=1 TO 5
1610 IF Y(Z)=0 OR Y(Z)>100 THEN GO TO 1800
1620 CLS
1630 PRINT "BBC/GALLUP ALBUM CHART"
1635 PRINT
1640 GO SUB 9505
1643 PRINT "ALBUM :- ";
1645 LET D=W(Z)*25+31975
1650 FOR A=D TO D+19
1655 PRINT CHR$(PEEK(A));
1660 NEXT A
1665 PRINT
1670 PRINT "WEEKS IN CHART = ";PEEK(A)
1675 PRINT "HIGHEST POSITION = ";PEEK(A+1)
1676 PRINT "LAST WEEK = ";PEEK(A+2)
1680 LET QQ=Y(Z)
1685 LET AA=A
1690 PRINT
1695 PRINT "PRESS N/L FOR NEW POSITION"
1696 INPUT B$
1700 GO SUB 1265
1710 PRINT
1720 PRINT "PRESS N/L"
1725 INPUT B$
1730 POKE AA,PEEK(AA)+1
1735 IF Y(Z)<PEEK(AA+1) OR PEEK(AA+1)=0 THEN POKE AA+1,Y(Z)
1736 POKE AA+2,Y(Z)
1800 NEXT Z
1810 FOR Z=1 TO 5
1811 IF Z(Z)=0 THEN GO TO 1870
1815 IF NOT (Z(Z)=999) THEN GO TO 1825
1816 LET Z(Z)=150
1820 LET U(Z)=RND(FANS/200)+FANS/200
1821 IF CULL=0 THEN LET U(Z)=U(Z)+REC1/2
1822 IF CULL>0 THEN LET U(Z)=U(Z)-CULL*2
1825 IF Z(Z)=1 AND RND(10)>4 THEN GO TO 1850
1830 LET Z(Z)=Z(Z)-U(Z)-RND(Z(Z)/8)
1831 IF Z(Z)<1 THEN LET Z(Z)=1
1835 IF Z(Z)<151 THEN GO TO 1850
1840 LET D=X(Z)*25+31475
1841 FOR A=D TO D+19
1842 PRINT CHR$(PEEK(A));
1843 NEXT A
1844 PRINT
1845 PRINT "HAS STOPPED SELLING"
1846 LET Z(Z)=0
1847 LET U(Z)=0
1848 LET X(Z)=0
1849 GO TO 1870
1850 IF Z(Z)<101 THEN LET FANS=FANS+40-Z(Z)
1855 IF U(Z)>0 THEN LET U(Z)=(U
Z)*Z(Z)/(Z(Z)+U(Z)))
1860 IF U(Z)<1 THEN LET U(Z)=-(R
ND(Z(Z)+U(Z))+RND(5))
1870 NEXT Z
1880 FOR Z=1 TO 5
1885 IF Y(Z)=0 THEN GO TO 1950
1890 IF NOT Y(Z)=999 THEN GO TO
1905
1895 LET Y(Z)=150
1900 LET V(Z)=RND(FANS/200)+FAN
/200
1905 IF Y(Z)=1 AND RND(10)>3 TH
N GO TO 1940
1910 LET Y(Z)=Y(Z)-V(Z)-RND(Y(Z
/8)
1911 IF Y(Z)<1 THEN LET Y(Z)=1
1915 IF Y(Z)<151 THEN GO TO 194
1920 LET D=W(Z)*25+31975
1921 FOR A=D TO D+19
1922 PRINT CHR$(PEEK(A));
1923 NEXT A
1924 PRINT
1925 PRINT "HAS STOPPED SELLING"
1928 LET Y(Z)=0
1930 LET V(Z)=0
1935 LET W(Z)=0
1937 GO TO 1950
1940 IF V(Z)>0 THEN LET V(Z)=V(
)*Y(Z)/(Y(Z)+V(Z))
1941 IF V(Z)<1 THEN LET V(Z)=-(R
ND(Y(Z)+V(Z))+RND(5))
1950 NEXT Z
1960 FOR A=1 TO 4
1965 FOR B=A+1 TO 5
1966 IF Y(A)=0 THEN GO TO 1974
1970 IF Y(A)=Y(B) THEN GO TO 19
5
1974 IF Z(A)=0 THEN GO TO 1980
1975 IF Z(A)=Z(B) THEN GO TO 19
0
1980 NEXT B
1981 NEXT A
1982 GO TO 2000
1985 LET Y(A)=Y(A)+1
1986 GO TO 1960
1990 LET Z(A)=Z(A)+1
1991 GO TO 1960
2000 GO SUB 9600
2010 GO SUB 9500
2020 PRINT "WEDNESDAY    WEEK ";W
EEK;"  ";YEAR
2030 PRINT
2040 PRINT "BOOKINGS"
2050 PRINT "▀▀▀▀▀▀▀▀"
2060 PRINT "DO YOU WANT TO BOOK,
..."
2070 PRINT
2080 PRINT ,"1) A RECORDING STU
IO"
2090 PRINT
2100 PRINT ,"2) A CONCERT HALL"
2110 PRINT
2120 PRINT ,"3) A PUB/CLUB HALL"
2130 PRINT
2140 PRINT ,"4) A HOLIDAY"
2145 PRINT
2147 PRINT ,"5) NOTHING"
2150 PRINT
2151 PRINT ,"OR..."
2152 PRINT ,"6) LIST BOOKINGS"
2160 PRINT "PLEASE ENTER ONE OF
THE ABOVE"
2170 INPUT A
2180 IF A<1 OR A>6 THEN GO TO 2
70
2190 IF A=5 THEN GO TO 3000
2200 GO TO A*100+2110
2210 GO SUB 9500
2211 GO SUB 110
2215 PRINT "RECORDING STUDIO CO
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TS"
2216 PRINT "▀▀▀▀▀▀▀▀▀▀▀▀▀▀ ▀▀▀▀▀▀▀▀▀▀ ▀▀▀▀
▀▀"
2220 PRINT "1 DAY   = £450"
2221 PRINT
2222 PRINT "2 DAYS  = £800"
2223 PRINT
2224 PRINT "3 DAYS  = £1400"
2225 PRINT
2230 GO SUB 2233
2231 GO TO 2252
2233 PRINT "PLEASE ENTER WHICH W
EEK YOU","WOULD LIKE TO BOOK,",,
"OR 99 TO PASS."
2234 INPUT B
2235 IF B=99 THEN GO TO 2010
2236 IF A(B)>0 THEN PRINT "YOU A
LREADY HAVE A BOOKING FOR  THIS
WEEK."
2237 IF A(B)>0 THEN GO TO 2234
2240 PRINT
2245 PRINT "WHICH OPTION WOULD Y
OU LIKE FOR WEEK ";B
2246 INPUT A
2247 IF A<1 OR A>3 THEN GO TO 22
46
2251 RETURN
2252 LET A(B)=A
2253 IF NOT A=1 THEN GO TO 2257
2254 LET CASH1=CASH1-450
2255 GO SUB 9450
2257 IF NOT A=2 THEN GO TO 2261
2259 LET CASH1=CASH1-800
2260 GO SUB 9450
2261 IF NOT A=3 THEN GO TO 2270
2263 LET CASH2=CASH2-1
2264 LET CASH1=CASH1-400
2265 GO SUB 9450
2270 GO TO 2010
2310 GO SUB 9500
2320 GO SUB 110
2330 PRINT "CONCERT HALLS"
2331 PRINT "▀▀▀▀▀▀▀ ▀▀▀▀▀"
2335 PRINT
2336 PRINT "1) CONCERT HALL     £5
000"
2337 PRINT
2338 PRINT "2) ARENA"," £50000"
2339 PRINT
2340 PRINT "3) STADIUM","£250000
"
2345 GO SUB 2233
2350 IF NOT A=1 THEN GO TO 2360
2354 LET CASH2=CASH2-5
2356 LET A(B)=A+4
2357 GO SUB 9450
2358 GO TO 2010
2360 IF NOT A=2 THEN GO TO 2370
2364 LET CASH2=CASH2-50
2365 GO TO 2356
2373 LET CASH2=CASH2-250
2375 GO TO 2356
2410 GO SUB 9500
2420 PRINT "PUB/CLUB HALL"
2421 PRINT "▀▀▀ ▀▀▀▀ ▀▀▀▀"
2422 PRINT "WHICH WEEK DO YOU WA
NT TO BOOK  OR 99 TO PASS."
2423 INPUT B
2424 IF B=99 THEN GO TO 2010
2425 IF A(B)>0 THEN GO TO 2423
2426 PRINT "WEEK ";B
2430 IF FANS>200 THEN GO TO 2450
2435 LET PA=100-FANS/10-RND(30)
2436 PRINT "THE MANAGER WANTS £"
;PA;" FOR","THE USE OF HIS HALL.
"
2438 PRINT "DO YOU ACCEPT?    (Y/N
)"
2440 INPUT B$
2442 IF B$="N" THEN GO TO 2010
2444 LET A(B)=50+PA
2445 GO SUB 9450
2446 GO SUB 9605
2447 GO TO 2010
2450 IF FANS<3000 THEN GO TO 247
0
2455 PRINT "THE MANAGER CANNOT R
ISK STAGING YOU AS THE GROUP IS
TOO BIG."
2460 GO SUB 9605
2461 GO TO 2010
2470 LET PA=FANS/7
2475 PRINT "THE MANAGER IS PREPA
RED TO PAY  YOU £";PA
2480 PRINT "DO YOU ACCEPT? (Y/N)
"
2481 INPUT B$
2482 IF B$="N" THEN GO TO 2010
2485 LET A(B)=150+PA/4
2490 GO SUB 9605
2495 GO TO 2010
2510 GO SUB 9500
2520 PRINT "HOLIDAY"
2521 PRINT "▀▀▀▀▀▀▀"
2525 PRINT "COST = £300"
2526 PRINT
2527 IF CASH1>299 OR CASH2>0 OR
CASH3>0 THEN GO TO 2530
2528 GO TO 2227
2530 PRINT "WHICH WEEK DO YOU WA
NT TO BOOK, OR 99 TO PASS."
2540 INPUT B
2550 IF B=99 THEN GO TO 2010
2560 IF A(B)>0 THEN GO TO 2540
2570 LET A(B)=8
2572 LET CASH1=CASH1-300
2574 GO SUB 9450
2580 GO SUB 9605
2590 GO TO 2010
2710 GO SUB 6000
2730 GO TO 2010
3000 GO SUB 9600
3010 GO SUB 9500
3020 PRINT "THURSDAY    WEEK ";WE
EK;"   ";YEAR
3030 PRINT
3040 IF A(WEEK)>0 THEN GO TO 310
0
3050 PRINT "YOU HAVE NO ARRANGEM
ENTS MADE"
3055 PRINT
3060 PRINT "FOR THIS WEEKEND. TH
E GROUPS"
3065 PRINT
3070 PRINT "FAITH IN YOU HAS DRO
PPED."
3075 LET MORALE=(MORALE/10)*9
3080 LET FANS=(FANS/10)*9
3090 GO TO 5000
3100 IF A(WEEK)>3 THEN GO TO 320
0
3110 PRINT "RECORDING"
3120 PRINT "▀▀▀▀▀▀▀▀▀"
3130 PRINT "THE GROUP HAVE SPENT
 ";A(WEEK),"DAYS IN THE RECORDIN
G STUDIO."
3140 IF RND((MORALE/2)*A(WEEK))>
99 THEN GO TO 3150
3145 PRINT "UNFORTUNATELY NONE O
F THEIR","RECORDINGS IS USABLE."
3148 GO TO 5000
3150 PRINT "THEY MADE A GOOD REC
ORDING."
3155 LET REC=REC+RND(A(WEEK))
3160 GO TO 5000
3199 STOP
3200 IF NOT A(WEEK)>49 THEN GO T
O 3300
3210 PRINT "PUB/CLUB HALL"
3220 PRINT "▀▀▀▀ ▀▀▀▀ ▀▀▀▀"
3224 LET FAN=FANS
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3225 LET FANS=(FANS/19)*20+RND(5
0)
3226 LET FAN=FANS-FAN
3230 IF A(WEEK)>150 THEN GO TO 3
260
3235 LET CASH1=CASH1+50-A(WEEK)
3240 GO SUB 9450
3245 PRINT "THE HALL COST £";A(W
EEK)-50
3246 PRINT "YOU GAINED ";FAN;" F
ANS"
3250 GO TO 5000
3260 PRINT "YOU HAVE BEEN PAID £
";(A(WEEK)-150)*4
3261 LET CASH1=CASH1+(A(WEEK)-15
0)*4
3262 GO SUB 9460
3265 LET MORALE=MORALE+10
3270 GO TO 3246
3300 IF NOT A(WEEK)=8 THEN GO TO
 3350
3310 PRINT "GROUP ON HOLIDAY"
3320 PRINT "▀▀▀▀▀ ▀▀ ▀▀▀▀▀▀▀"
3330 PRINT "A WELL EARNED BREAK
FOR THE","GROUP"
3340 GO TO 5000
3350 IF NOT A(WEEK)=5 THEN GO TO
 3400
3355 PRINT "CONCERT HALL"
3356 PRINT "▀▀▀▀▀▀▀ ▀▀▀▀"
3360 GO TO 3510
3400 IF A(WEEK)=6 THEN GO TO 350
0
3410 PRINT "STADIUM"
3411 PRINT "▀▀▀▀▀▀▀"
3420 GO TO 3510
3500 PRINT "ARENA"
3501 PRINT "▀▀▀▀▀"
3510 IF RND(12)>9 THEN GO TO 355
0
3520 PRINT "A GOOD CONCERT."
3530 LET FAN=FANS
3535 LET FANS=(FANS/10)*11
3536 IF FANS>20000 THEN LET FANS
=(FANS/12)*11
3540 LET FAN=FANS-FAN
3541 PRINT "POPULARITY RATING CH
ANGED","BY ";FAN
3544 IF A(WEEK)=7 THEN LET CASH2
=CASH2+300
3545 IF A(WEEK)=5 THEN LET CASH2
=CASH2+6
3546 IF A(WEEK)=6 THEN LET CASH2
=CASH2+60
3547 GO SUB 9460
3548 GO TO 5000
3550 PRINT "A BAD CONCERT."
3555 LET FANS=FANS-FANS/10
3556 IF A(WEEK)=5 THEN LET CASH2
=CASH2+4
3557 IF A(WEEK)=6 THEN LET CASH2
=CASH2+40
3558 IF A(WEEK)=7 THEN LET CASH2
=CASH2+200
3560 GO TO 3547
5000 IF A(WEEK)<4 OR A(WEEK)=8 T
HEN LET FANS=(FANS/10)*9
5005 LET A(WEEK)=0
5009 GO SUB 9600
5010 GO SUB 9500
5020 PRINT "END OF WEEK ";WEEK;"
 ";YEAR
5030 PRINT
5040 GO SUB 110
5050 PRINT "GROUP MORALE = ";MOR
ALE
5062 PRINT
5065 PRINT "POPULARITY = ";FAN
S
5070 PRINT
5073 PRINT "UNRELEASED RECORDING
S = ";REC
5080 PRINT
5090 PRINT ,,"CHARTS"
5100 PRINT ,,"▀▀▀▀▀▀"
5110 PRINT ," SINGLES          ALBU
S"
5115 PRINT
5120 FOR A=1 TO 5
5121 LET XX=PEEK(X(A)*25+31497)
5122 LET WW=PEEK(W(A)*25+31997)
5130 IF Z(A)=0 AND Y(A)=0 THEN
0 TO 5150
5135 IF XX>0 AND XX<101 THEN PR
NT ," NO.";XX,
5136 IF XX>100 THEN PRINT ,"
-";
5137 IF XX=0 THEN PRINT ,"
;
5140 IF WW>0 AND WW<101 THEN PR
NT "      NO.";WW
5145 IF WW>100 THEN PRINT ," -"
5146 IF WW=0 THEN PRINT ,"   "
5150 NEXT A
5158 LET SET=0
5159 IF TIME=1 THEN LET SET=1
5160 IF TIME>1 THEN LET TIME=TI
E-1
5165 LET WEEK=WEEK+1
5166 IF WEEK=53 THEN LET YEAR=Y
AR+1
5167 IF WEEK=53 THEN LET WEEK=1
5200 PRINT
5210 GO SUB 9605
5230 GO SUB 9500
5240 PRINT
5250 PRINT "FOR DETAILS OF CHAR
 SUCCESS"
5260 PRINT
5270 PRINT "SO FAR , PRESS ";CH
$(212);"A";CHR$(212);" THEN N/L
5280 PRINT
5285 PRINT
5290 PRINT "FOR A NEW WEEK JUST
PRESS N/L."
5300 INPUT B$
5320 IF B$="" THEN GO TO 5500
5330 IF NOT B$="A" THEN GO TO 5
00
5340 GO SUB 9500
5345 PRINT "SINGLES"
5346 PRINT "▀▀▀▀▀▀▀"
5348 IF SINGLE=0 THEN PRINT "NO
SINGLES HAVE BEEN RELEASED"
5349 IF SINGLE=0 THEN GO TO 539
5350 PRINT "TITLE",,"        WKS
 HI"
5355 FOR A=1 TO SINGLE
5358 IF SINGLE<8 THEN PRINT
5360 LET D=A*25+31475
5365 FOR B=D TO D+19
5370 PRINT CHR$(PEEK(B));
5371 IF PEEK(B)=1 THEN PRINT "
;
5375 NEXT B
5380 PRINT ,PEEK(B);"   ";
5381 IF PEEK(B)<10 THEN PRINT "
";
5382 PRINT PEEK(B+1)
5385 NEXT A
5390 PRINT "PRESS N/L FOR ALBUM
5395 INPUT B$
5400 GO SUB 9500
5405 PRINT "ALBUMS"
5406 PRINT "▀▀▀▀▀▀"
5410 IF ALBUM=0 THEN PRINT "NO A
LBUMS HAVE BEEN RELEASED"
5411 IF ALBUM=0 THEN GO TO 5480
5420 PRINT "TITLE",,"        WKS
 HI"
5425 FOR A=1 TO ALBUM
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5430 IF ALBUM<8 THEN PRINT
5435 LET D=25*A+31975
5440 FOR B=D TO D+19
5445 PRINT CHR$(PEEK(B));
5446 IF PEEK(B)=1 THEN PRINT " "
;
5450 NEXT B
5456 IF PEEK(B)<10 THEN PRINT "
";
5457 PRINT PEEK(B+1)
5460 NEXT A
5480 PRINT "PRESS N/L FOR A NEW
WEEK"
5485 INPUT B$
5500 IF SINGLE<16 THEN GO TO 551
0
5501 FOR N=31500 TO 31850
5502 POKE N,PEEK(N+25)
5503 NEXT N
5504 LET SINGLE=15
5505 FOR N=1 TO 5
5506 LET X(N)=X(N)-25
5507 NEXT N
5510 IF ALBUM<11 THEN GO TO 5519
5511 FOR N=32000 TO 32225
5512 POKE N,PEEK(N+25)
5513 NEXT N
5514 LET ALBUM=10
5515 FOR N=1 TO 5
5516 LET W(N)=W(N)-25
5517 NEXT N
5519 IF SET=0 THEN GO TO 95
5520 GO SUB 9500
5530 PRINT "YOUR CONTRACT WITH "
;C$
5540 PRINT "HAS EXPIRED. AS THEY
 OWN THE       RIGHTS TO YOUR RECOR
DINGS YOU      WILL NO LONGER RECIE
VE PAYMENT     FROM THEM."
5550 PRINT
5560 GO SUB 9605
5580 GO TO 95
6010 FOR A=0 TO 3
6015 GO SUB 9500
6016 PRINT "WEEK ";WEEK;"    ";YEA
R
6017 PRINT
6020 PRINT ,"BOOKINGS"
6021 PRINT ,"--------"
6022 PRINT "WEEK","EVENT"
6025 FOR B=A*13+1 TO A*13+13
6030 PRINT B,
6035 IF A(B)=0 THEN PRINT "-"
6040 IF A(B)>0 AND A(B)<4 THEN P
RINT "RECORDING ";A(B)
6050 IF A(B)>49 THEN PRINT "PUB/
CLUB HALL"
6060 IF A(B)=5 THEN PRINT "CONCE
RT HALL"
6061 IF A(B)=6 THEN PRINT "ARENA
"
6062 IF A(B)=7 THEN PRINT "STADI
UM"
6070 IF A(B)=8 THEN PRINT "HOLID
AY"
6100 NEXT B
6110 GO SUB 9605
6120 NEXT A
6200 RETURN
8999 STOP
9000 FOR N=1 TO 10
9001 PRINT ,"CHART - TOPPER"
9002 NEXT N
9010 PRINT ,"------     ------"
9030 PRINT " YOU ARE THE MANAG
ER OF A POPGROUP. THE GROUP HA
VE ENTRUSTEDUPON YOU THE TASK
 OF STEERINGTHEM TO THE TOP OF T
HE CHARTS."
9035 PRINT
9040 PRINT " THEY HAVE YET TO
 PLAY THEIRFIRST LIVE SHOW, SO
YOU MAY FINDIT DIFFICULT TO GET
A BOOKING."
9060 PRINT
9070 PRINT "TO START PLEASE ENTE
R THE NAME OF YOUR GROUP."
9080 INPUT A$
9090 CLS
9100 LET CASH1=500
9110 LET CASH2=1
9120 LET CASH3=0
9150 LET FANS=0
9160 DIM A(52)
9170 LET WEEK=1
9180 LET YEAR=1984
9190 LET ALBUM=0
9200 LET SINGLE=0
9210 LET MORALE=100
9220 LET Z$=""
9230 LET Y$=""
9240 DIM Z(5)
9250 DIM Y(5)
9260 DIM X(5)
9270 DIM W(5)
9271 DIM S(5)
9272 DIM U(5)
9273 DIM V(5)
9280 LET REC=0
9290 LET TIME=0
9300 LET CULL=0
9400 RETURN
9451 IF CASH1>-1 THEN GO TO 9455
9452 LET CASH1=CASH1+1000
9453 LET CASH2=CASH2-1
9455 IF CASH2>-1 THEN GO TO 9459
9456 LET CASH2=CASH2+1000
9457 LET CASH3=CASH3-1
9458 IF CASH3=-1 THEN GO TO 9900
9459 RETURN
9461 IF CASH1<1001 THEN GO TO 94
64
9462 LET CASH1=CASH1-1000
9463 LET CASH2=CASH2+1
9464 IF CASH2<1001 THEN GO TO 94
67
9465 LET CASH2=CASH2-1000
9466 LET CASH3=CASH3+1
9469 RETURN
9500 CLS
9505 LET B$=A$
9506 PRINT CHR$(128);
9510 LET B=CODE(B$)
9520 IF B=1 THEN GO TO 9560
9530 PRINT CHR$(B+128);
9540 LET B$=TL$(B$)
9550 GO TO 9510
9560 PRINT CHR$(128)
9565 PRINT
9570 RETURN
9600 PRINT
9604 PRINT "END OF DAY.";
9605 PRINT "PRESS N/L TO CONTINU
E"
9610 INPUT B$
9620 CLS
9630 RETURN
9700 PRINT
9701 PRINT "HOW MANY RECORDINGS
TO BE USED   FOR THIS RELEASE ?"
9705 INPUT REC1
9710 IF REC1<4 OR REC1>REC THEN
GO TO 9705
9711 LET REC=REC-REC1
9715 RETURN
9900 GO SUB 9500
9910 PRINT "****THE GROUP HAVE G
ONE BUST****"
9920 PRINT
9930 PRINT "*****YOU HAVE BEEN
SACKED******"
9940 GO TO 9930
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Across The Pond

Mark Fendrick examines some of the add-ons available to U.S. owners.

One of the major factors in the decision to purchase a T/S 2068, for many of us, was the promise of microdrives. We had read about Sinclair microdrives and after experiencing the extremely slow cassette interface on the T/S 1000, we could hardly wait. The prototype Timex/Sinclair microdrive was demonstrated by Dan Ross (of Timex Computer Corporation) at the Timex Celebration held by the Boston Society in October, 1983. Then, in February, 1984, all our dreams went up in smoke, or at least so it seemed.

Emulators

Another device utilised by Mr. Ross to demonstrate some Spectrum software, was a small board which, when inserted into the T/S Command Cartridge port, allows the T/S 2068 to run Spectrum software. This was called the Chamelon, and was a possible product for future release. With this device, the vast range of British software available for the Spectrum would now work on our computers. Thanks to two enterprising individuals, T/S 2068 owners can now indeed use virtually all available Spectrum software.

Taking his cue from Timex, Douglass Dewey, founder and president of the Triangle Sinclair Users Group of Carrboro, North Carolina, developed and marketed his version of the Chameleon. The EMU-1 and its big brother, the EMU-2, are boards which contain a pseudo Spectrum ROM. (The EMU-2 is identical to the EMU-1 except for the fact that it contains an additional IC holder into which you may insert an EPROM of your own). As with other Command Cartridges, when inserted into the cartridge port, and the computer is turned on, the bank switching capabilities of the T/S 2068 are called into play, running whatever software has been programmed into the cartridge. In this case, when you first switch on your computer, the normal double copyright (Timex & Sinclair) is displayed. Then, automatically, a second initialisation takes place and this time only the Sinclair copyright remains. Now, for practically all purposes, you are running a ZX Spectrum. (The only exception discovered occurs when the interrupt register is invoked. Since the U.S. power system is 60 cycles, the 50 cycle interrupt is not compatible with U.S. hardware). Using the EMU series of emulators does not require any modification of the T/S 2068 itself, as they are inserted and removed without opening the case.

A second emulation device was developed by Bill Russell of G. Russell Electronics (best known for their WINKY BOARD cassette/computer interfaces). Known as the ROMSWITCH, it is a device which allows both the Timex and Spectrum ROM's to co-exist inside the T/S and to be selected by means of a switch which gets placed onto the keyboard. The ROMSWITCH itself consists of a small PC board whose most prominent features are two IC holders, one of which contains an issue 3 Spectrum ROM. The other socket is empty when you first receive the kit. A small glass enclosed switch completes the device. (Most dealers who sell this product also offer to install it for a fee, but it is so simple that I suggest that you consider doing it yourself). To install the ROMSWITCH you first remove the screws which hold the case together. You then lift the top off and locate the ROM chip, identified clearly in the instructions supplied. You next simply remove this chip and insert it in the empty socket on the PC board, which then is placed into the IC holder from which you have removed the Timex ROM. Now you replace the top of the case and reinsert the screws. The external keyboard switch is a self-adhesive channel through which a small magnet travels. This magnet affects the switch on the ROMSWITCH board and thereby selects either the T/S 2068 or Spectrum operating system. You place this assembly next to the "0" key, and once you have ascertained that it is positioned correctly, and does indeed switch the ROMs, you remove the backing and stick it in place. It's that simple. This was the first time I had opened any computer, not being much of a tinkerer, and managed to install the switch and run Spectrum programs in under five minutes. There is no drilling, soldering or cutting involved, and the only tool required is a screwdriver. If I can do it, anyone can.

Either emulator does a fine job and both are a better alternative than simply replacing the Timex ROM with a Spectrum ROM. There still is some fine software written for the T/S 2068, and this modification would render much of what's available inoperable. There are many advanced features of the T/S 2068 which would be lost using a Spectrum ROM alone. The EMU or ROMSWITCH gives you the best of both worlds.

Unfortunately, the expansion bus on the T/S 2068 is arranged differently than on the Spectrum, therefore even with a Spectrum emulator, it is not hardware compatible, thus still precluding the use of any Spectrum add-ons, including ZX Microdrives. That challenge has been taken up and a device called Z-link has been developed. This interface attaches to the T/S 2068's expansion bus and rearranges the lines so that the output side of Z-link presents a Spectrum configuration. Using this device with either the EMU or ROMSWITCH will allow you to connect many Spectrum peripherals. You may now use any of the Spectrum compatible joystick interfaces, which are utilised by many Spectrum games. (Remember that this is all in Spectrum mode, therefore you cannot use the built-in joystick ports on your T/S).

At the time I am writing this a number of new products are coming onto the market which are able to interface the T/S 2068 with an Interface 1. This, of course would finally make the ZX Microdrives available to T/S users. Damco, of Fall River, Massachusettes, is offering a system based on the Rotronics Wafadrive which is available in the U.K. There are two versions available; one which includes a Spectrum ROM; one for those who already own a Spectrum emulator. It is a two-drive system featuring a Centronics as well as an RS232 port. The interface itself reconfigures the expansion bus, and the through port allows the use of Spectrum compatible add-ons. As with many mass storage packages, the Damco/Rotronics system comes with a word processor program which is said to be as good as Tasword II. However, there are some drawbacks. As with all Spectrum emulation devices, you cannot run many T/S 2068 programs, and you lose all of the T/S advanced features. Additionally, since the edge connector has been reconfigured, the T/S 2040 printer now is inoperative. (Hmmmm. . . I wonder if this means that my ZX printer will work?)

Now, even this has been dealt with. The A&J MicroDrive company of Sunnyvale, California, has developed a microdrive which operates on the completely unmodified T/S 2068. No newcomer to the field, A&J has been selling a microdrive for the T/S 1000 since before the introduction of the T/S 2068 and T/S 1500. Both models use a stringy floppy wafer (the T/S 2068 model uses the same wafer as the Damco/Rotronics drives) onto which the data is transferred at a rate of 11400 baud. This is approximately ten times faster than the normal T/S 2068 cassette rate, and more than forty times faster than the normal rate on the T/S 1000/1500. The interface contains a built in Centronics interface which, when the proper software and cables are attached, allow you to use most full size printers. With the A&J system, all of the Timex's advanced features are retained. At the moment, it does not operate in Spectrum mode, but there is work being done in that direction.

In the last few weeks a few Disk Drive interfaces have appeared, but that is a column all by itself. As always, I enjoy hearing from you, and look forward to your letters. The Sinclair community is quite unique in the amount of support and cooperation between the dealers and owner/users. In North America, this is what keeps us strong. Write to me at:

Mark L. Fendrick
P.O. Box 2392
Secaucus,
New Jersey
07094-09992
USA



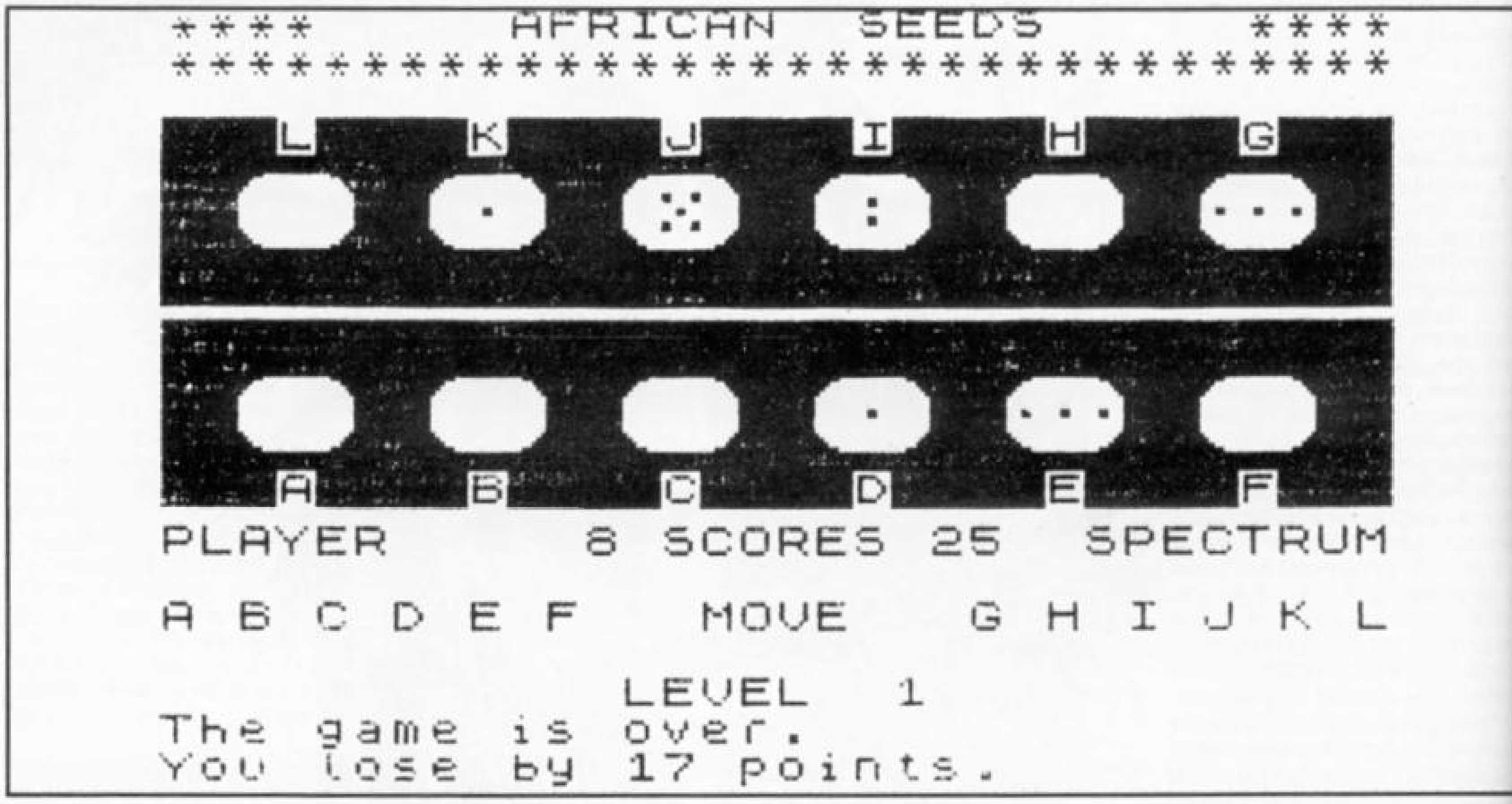
AFRICAN SEEDS

Down in darkest Gwent something stirs. It's MJ Edwards playing this brain testing game!!!

AFRICAN SEEDS is based on the mancala games popular in Africa. The nature of the games varies widely from place to place, but they are usually based on capturing counters from rows of cells. The counters may be seeds, beans, stones or twigs. The cells may be holes in the ground, cups, or hollows in beautifully carved wooden game-boards. There may be two, three or four players' and either two or four rows of cells, and the way they are divided between the players, and the conditions under which capture can occur, vary according to whether the game is Awari, Ayo, Ba-Awa, Lontu-holo, Wari, Whyo, or one of the four-rank mancala games. Wari and Awari are probably the most profound in strategy, and are considered to be on a level with chess, but other games are faster, with more dramatic changes in fortune.

The games are well suited for computer play. The element of calculation is important, and computers can be programmed without too much difficulty to beat humans. From the player's point of view, it is much easier to type in a letter on a computer keyboard, than to pick up maybe thirteen counters from one cup and put them individually into another row of cups.

This program can be beaten – though at level 0 you'll have to work rather hard to do so. Sometimes you will see how to win easily, but a sequence of lifts can continue for, say, twenty-five moves, and the computer is rather better at keeping track of them than I am! Don't lose heart, though, the computer's depth of search is deliberately limited — and even at its highest level, it's still capable of blunders just as big as yours. At the start of the game, the computer tosses for first move. If you win, you will be invited to enter a letter to denote the cup you want to lift. The computer will take the seeds out, and sow them in successive cups in an anticlockwise direction. If the final seed of the lift falls into an occupied cell, all the seeds in that cell are lifted and the sowing continues as before. Otherwise, if the final seed lands in an empty hole — and the sowing must continue until this is so – you capture the seeds in the hole immediately opposite, if it is in your opponent's row, or none if it is in your own row. The only problem with making captures is that you leave the computer with no seeds to play, it will claim the win by forfeit. With that proviso, once you have cap- ▶



tured twenty-five or more seeds, the victory is yours.

The computer's speed of response depends upon the level chosen, but is reasonably fast anyway. Just in case you get bored, you are treated to a display of flashing lights and bleeps (a feature lacking in the African originals!). They are intended for more than diversion, though — they show which moves are being made or considered. A steady blue light shows the cup where a sequence of lifts ends. A flashing blue light shows where a capture occurs.

The structure of the program is simple, and the table should make it easy to modify. For example, if you leave out the instructions and some "special effects", it ought to be possible to squeeze it all into a 16K Spectrum. Or, you might prefer to display integers, as in Lines 2325-2330, instead of the pips in Lines 2301-2324. If you want to make the computer stronger, then you could replace the part of Line 1150 after the Input with the simpler "GO TO 1300", and replace the "+20" in Line 1070 with "+50". Save the program with (using whatever title you like) SAVE "AS" LINE 1000.

LINES	FUNCTION	SUBROUTINES CALLED
1000	Initialise	Display User-defined graphics Instructions Codes for print positions held in strings
1200	Computer's move	End check
1300	Analysis and evaluation	Move check and capture check Display board End check
1500	Player's move	Make move Tidy display Display board
	GO TO 1200 ELSE END	

Subroutines:

100	Lift and sow = Make or Check a move
200	Check for end of move and capture
300	Display board
400	Tidy display
500/600	Result = END
700	End of game check
2100	Display
2100	User-defined graphics
2160	Codes for letter positions
3000	Codes for seed positions
2400	Instructions

Variables used:

zx	set to 1 for computer's move
d	depth of search
l	level chosen
c	stalemate counter
sc	set to 1 to make a move, or set to 0 to evaluate the position
win	number of points scored on a move
end	set to one if a sequence of lifts reaches an end
op	the cell opposite the end of a sequence of lifts

Arrays used:

b(12)	board positions
h(12)	model board for analysis
m(12)	move evaluation
s(2)	the scores: s(1) is the computer's, and s(2) the player's
a$(12)	column positions for letter display
x$(12)	row positions for seed display
y$(12)	column positions for seed display

Data and user-defined graphics:

Lines 2300-2324 consititute a "look-up" table which works must faster than a user-defined function displays integers. Graphics A to H represent the numbers 1 to 8. Graphics I to L represent the corners of the cups in the order top right, top left, bottom left, bottom right.

```
   1 REM *********************
        *Underlined characters*
        *are entered in      *
        *GRAPHICS mode.      *
        *********************
 100 PRINT AT 17,CODE a$(h); BRI
GHT 1; PAPER 2;SCREEN$ (17,CODE
a$(h)): LET s=h(h): LET h(h)=0:
LET d=d+1
 110 IF s THEN  LET s=s-1: LET h
=h+1-12*(h=12): LET h(h)=h(h)+1:
```

```
GO TO 110
 200 PRINT AT 17,CODE a$(h); BRI
GHT 1; INK 0; PAPER 2;SCREEN$ (1
7,CODE a$(h)): IF h(h)<>1 THEN
FOR b=10 TO 10+h(h): BEEP .002,b
+d: NEXT b: RETURN
 210 PRINT AT 17,CODE a$(h); PAP
ER 5; BRIGHT 1;SCREEN$ (17,CODE
a$(h));: LET end=1: LET op=13-h:
 FOR b=20 TO 20+h(op): BEEP .02,
b: NEXT b: IF (NOT zx AND op<7)
OR (zx AND op>6) OR NOT h(op) TH
EN  RETURN
 220 LET win=h(op): LET h(op)=0:
 LET s(2-zx)=s(2-zx)+win*sc: PRI
NT AT 17,CODE a$(op); FLASH 1; B
RIGHT 1; PAPER 5;SCREEN$ (17,COD
E a$(op)): FOR b=30 TO 30+win: B
EEP .025,b: NEXT b: RETURN
 300 PRINT AT 19,0;"          ";AT
 19,12; BRIGHT 1; PAPER (d-8*INT
 (d/8)); INK 9;" MOVE ";d;" ";:
FOR p=1 TO 12: RESTORE 2300+b(p)
: READ n$
 330 PRINT AT CODE x$(p),CODE y$
(p);n$: LET h(p)=b(p): BEEP .005
,d+b(p): NEXT p
 340 PRINT AT 15,11;s(2);: PRINT
 AT 15,20;s(1): PRINT AT 19,11;l
$: RETURN
 400 BRIGHT 0: PRINT AT 17,0; PA
PER 4;"A B C D E F   MOVE   G H
I J K L": RETURN
 500 PRINT ("You lose by "+STR$
(s(1)-s(2))+" points." AND s(1)>
s(2))+("You win by "+STR$ (s(2)-
s(1))+" points." AND s(1)<s(2))
 510 GO SUB 400
 520 PRINT AT 0,0: INPUT "Do you
 want a return match ? "; LINE u
$: IF CODE u$=89+32*(u$="y") THE
N  GO TO 1040
 530 STOP
 580 PRINT AT 18,0;"Cups ";("A t
o L" AND zx);("G to L" AND NOT z
x);" are empty."'"The remaining
seeds are forfeit."
 600 PRINT AT 20,0;"The game is
";("drawn." AND s(1)=s(2));("ove
r." AND s(1)<>s(2)): GO TO 500
 700 IF s(1)>24 OR s(2)>24 THEN
 GO TO 600
 710 IF s(1)+s(2)>39 AND NOT win
 THEN  LET c=c+1: IF c>10 THEN
GO TO 600
 720 RETURN
1000 LET d=0: DIM s(2): DIM b(12
): DIM h(12): DIM a$(12): DIM c$
(12): DIM x$(12): DIM y$(12)
1010 RESTORE 2100: FOR p=0 TO 95
: READ g: POKE USR "a"+p,g: NEXT
 p
1020 GO SUB 2000: PRINT AT 19,7;
 INK 0;"Do you wish to see";AT 2
0,7;"the  instructions?";AT 21,1
3;"(Y/N)": INPUT  LINE u$: IF CO
DE u$-32*(u$="y")=89 THEN  GO SU
B 2400
1030 RESTORE 2160: FOR n=1 TO 12
: READ a: LET a$(n)=CHR$ a: NEXT
 n
1040 GO SUB 2020
1060 GO SUB 2080: INPUT  LINE u$
: IF u$<"0" OR u$>"9" THEN  GO T
O 1060
1070 LET l=VAL u$+20*(u$="0"): P
RINT AT 15,0;"
  ": FOR p=15 TO 21 STEP 2: PRIN
T AT p,20;"           ": NEXT p
: LET l$=" LEVEL  "+u$+" "
1080 RESTORE 3000: FOR n=1 TO 12
: READ x,y: PRINT AT x,y;"    ";A
T x+2-4*(n>6),y+1; INK 7; PAPER
0; BRIGHT 1;CHR$ (64+n): LET x$(
n)=CHR$ x: LET y$(n)=CHR$ y: NEX
T n
1090 PRINT AT 15,0; BRIGHT 1; PA
PER 1; INK 7;"PLAYER        SCORE
S     SPECTRUM"
1100 DIM m(12): LET t=0: LET sc=
0: LET c=0: LET s(1)=0: LET s(2)
=0: FOR p=1 TO 12: LET b(p)=4: L
ET h(p)=4: NEXT p
1110 RANDOMIZE : LET zx=INT (RND
*2)
1120 GO SUB 300: GO SUB 400
1150 IF zx THEN  PRINT AT 17,19;
 BRIGHT 1; INK 7; PAPER 1;">": I
NPUT "You have lost the toss.
      Press ENTER when you're re
ady.  "; LINE u$: LET pref=INT (
RND*7+6): GO TO 1400
1200 IF NOT zx THEN  GO TO 1500
1210 GO SUB 700
1220 IF NOT (b(7)+b(8)+b(9)+b(10
)+b(11)+b(12)) THEN  LET s(1)=s(
1)+48-s(1)-s(2): GO TO 580
1230 LET op=0: LET sc=0: LET win
=0: DIM m(12)
1250 PRINT AT 17,19; BRIGHT 1; I
NK 7; PAPER 1;">": INPUT "Press
ENTER for a reply, please."; LIN
E u$: GO SUB 400: IF u$="end" TH
EN  GO TO 600
1300 PRINT AT 19,0;"ANALYSE ": F
OR p=7 TO 12: LET d=0: LET end=0
: LET win=0: LET op=0: IF NOT b(
p) THEN  GO TO 1350
```

```
1320 LET h=p: LET m=p:: FOR k=1
TO 12: LET h(k)=b(k): NEXT k
1330 GO SUB 400: GO SUB 100: IF
d<1 AND NOT end THEN  GO TO 1330
1340 LET m(p)=win*end
1350 NEXT p
1360 LET pref=7: PRINT AT 19,0;"
EVALUATE": FOR p=7 TO 12: IF m(p
)>m(pref) THEN  LET pref=p
1370 NEXT p
1380 LET b=0: FOR p=7 TO 12: IF
p<>pref THEN  IF b(p)>0 THEN  IF
 m(p)=m(pref) THEN  LET b=b+1: L
ET m(b)=p
1390 NEXT p: IF b THEN  LET pref
=m(INT (RND*b)+1)
1400 LET end=0: LET d=0: LET op=
0: LET sc=1: LET h=pref: LET win
=0: GO SUB 400: FOR p=1 TO 12: L
ET h(p)=b(p): NEXT p
1410 PRINT AT 17,CODE a$(h); BRI
GHT 1; PAPER 2;SCREEN$ (17,CODE
a$(h)): GO SUB 100
1440 FOR p=1 TO 12: LET b(p)=h(p
): NEXT p: GO SUB 300: IF NOT en
d THEN  GO SUB 400: GO TO 1410
1450 GO SUB 700
1490 IF NOT (b(1)+b(2)+b(3)+b(4)
+b(5)+b(6)) THEN  LET s(2)=s(2)+
48-s(1)-s(2): GO TO 580
1500 PRINT AT 17,12; BRIGHT 1; I
NK 7; PAPER 1;"<": INPUT "Your m
ove. Enter the cup letter."; LIN
E u$: IF u$="end" THEN  GO TO 60
0
1540 LET h=CODE u$-64-32*(u$>"Z"
): GO SUB 400: IF h<0 OR h>6 THE
N  PRINT AT 21,0;"Illegal move:
please re-enter.": GO TO 1500
1550 LET d=0: LET zx=0: LET sc=1
: LET win=0: LET op=0: IF NOT b(
h) THEN  GO TO 1500
1560 PRINT AT 17,CODE a$(h); BRI
GHT 1; PAPER 2;SCREEN$ (17,CODE
a$(h)): GO SUB 100
1570 FOR p=1 TO 12: LET b(p)=h(p
): NEXT p: IF NOT op THEN  GO SU
B 300: GO SUB 400: GO TO 1560
1580 GO SUB 300: LET zx=1
1590 GO TO 1200
2000 BORDER 4: PAPER 4: INK 2: C
LS : PRINT '''████ ████ ███  █ █
██ ███ ██  ███ █ ██   █ █  █ █
█  ██ █ ███ ████ ███  ███ █ █
█  ███ ██ ███  █ ██   █ █ █ █
██ █  █ █  ██"
2005 PRINT ''"   ████  ████  ████
  ███  ███   █   ██   ██
  ██ █  █    ███  ███  ███
  ██ █   ████    ████    ███
  ████  ███    "
2010 PRINT AT 16,6; INK 0; Mik
e Edwards, 1983": RETURN
2020 BORDER 6: PAPER 6: INK 0: C
LS : PRINT  PAPER 4;"****     AF
RICAN  SEEDS      **************
********************"
2030 PRINT '"
        █J▀I█J▀I█J▀I█J▀
I█J▀I█J▀I███  ██  ██  ██
 ██   ██   ███K▄L█K▄L█K▄L█K▄
L█K▄L█K▄L█████████████████████
████████████"
2040 PRINT  PAPER 1;"
         "
2050 PRINT "
        █J▀I█J▀I█J▀I█J▀I
█J▀I█J▀I███  ██  ██  ██
██   ██   ███K▄L█K▄L█K▄L█K▄L
█K▄L█K▄L█████████████████████
████████████"
2060 RETURN
2080 PRINT AT 15,0;"ENTER SKILL
LEVEL : 1-3 = BASIC"'';TAB 20;"4
-6 = EASY";''TAB 20;"7-9 = HARD"
;''TAB 22;"0 = EXPERT"
2090 RETURN
2100 DATA 0,0,0,24,24,0,0,0
2101 DATA 0,24,24,0,0,24,24,0
2102 DATA 24,24,0,24,24,0,24,24
2103 DATA 0,102,102,0,0,102,102,
0
2104 DATA 195,195,0,24,24,0,195,
195
2105 DATA 102,102,0,102,102,0,10
2,102
2106 DATA 102,102,0,219,219,0,10
2,102
2107 DATA 219,219,0,195,195,0,21
9,219
2108 DATA 255,255,255,255,31,7,3
,1
2109 DATA 255,255,255,255,248,22
4,192,128
2110 DATA 128,192,224,248,255,25
5,255,255
2111 DATA 1,3,7,31,255,255,255,2
55
2160 DATA 0,2,4,6,8,10,21,23,25,
27,29,31
2300 DATA "   "
2301 DATA " A "
2302 DATA " B "
2303 DATA "AAA"
2304 DATA " D "
2305 DATA " E "
2306 DATA "BBB"
```

```
2307 DATA "BCB"
2308 DATA "BDB"
2309 DATA "CCC"
2310 DATA "CDC"
2311 DATA "CEC"
2312 DATA "DDD"
2313 DATA "DED"
2314 DATA "EDE"
2315 DATA "FCF"
2316 DATA "FDF"
2317 DATA "GCG"
2318 DATA "FFF"
2319 DATA "HCH"
2320 DATA "HDH"
2321 DATA "GGG"
2322 DATA "HFH"
2323 DATA "HGH"
2324 DATA "HHH"
2325 DATA " 25"
2326 DATA " 26"
2327 DATA " 27"
2328 DATA " 28"
2329 DATA " 29"
2330 DATA " 30"
2400 BORDER 4: PAPER 4: INK 0: C
LS : PRINT "****      AFRICAN  SE
EDS      ***********************
************"
2410 PRINT '"  AFRICAN SEEDS is
 based on the African Mancala ga
mes, though   its rules are simp
ler than thoseof many of the ori
ginals."
2420 PRINT '"  In this version t
welve cups offour seeds are divi
ded equally  between the players
.  The aim isto score points by
capturing as many seeds as possi
ble.  A scoreof twenty-five ensu
res victory."
2430 INPUT "Press any key to con
tinue  "; LINE u$
2440 BORDER 4: PAPER 4: INK 0: C
LS : PRINT "****      AFRICAN  SE
EDS      ***********************
************"
2450 PRINT '"  Each player in t
urn takes the seeds from any one
 of his cups, and sows them one
by one into   successive cups an
ti-clockwise  round the board, s
tarting with  the cup next to th
e source cup."
2460 PRINT '"  If the last seed
of the move  lands in an occupie
d cup, the   player lifts all th
e seeds from it and continues so
wing.  Play  goes on in this way
 until a moveends in  an empty c
up."
2470 PRINT '"  If the turn ends
in an empty  cup in the opposing
 rank, or    opposite an empty c
up, then playpasses to the oppon
ent."
2480 INPUT "Press any key to con
tinue  "; LINE u$
2490 BORDER 4: PAPER 4: INK 0: C
LS : PRINT "****      AFRICAN  SE
EDS      ***********************
************"
2500 PRINT '"  Captures are pos
sible only if the last seed of a
 move lands inan empty cup in th
e player's ownrank, opposite an
occupied cup. Then the seeds in
the opposing  cup are removed an
d their numberis added to the pl
ayer's score."
2510 PRINT '"  Play goes on in t
his way untilone player has more
 than twenty-four points, or bot
h players    agree that the resu
lt is clear."
2520 PRINT '"  One caution: if y
ou leave youropponent without se
eds to play  on his turn, then a
ny seeds thatremain on the board
 are forfeit to him."
2530 INPUT "Press any key to con
tinue  "; LINE u$
2540 BORDER 4: PAPER 4: INK 0: C
LS : PRINT "****      AFRICAN  SE
EDS      ***********************
************"
2550 PRINT '"  The first player
 is decided atrandom by the comp
uter."'"You have cups A to F."'"
The computer has  cups G to L."
2560 PRINT '"  When you are invi
ted to move, simply enter the le
tter of the  cup whose seeds you
 wish to sow.The computer will
wait for you to press ENTER befo
re making itsown move."
2570 PRINT '"  When the game is
resolved, thecomputer will end i
t and declarethe result.  You ca
n stop play  at any time by typi
ng ""end""."
2580 INPUT "Press R to repeat, o
r any other key to play the game
 "; LINE z$: IF CODE z$=82+32*(
z$="r") THEN  GO TO 2400
2590 RETURN
3000 DATA 11,2,11,7,11,12,11,17,
11,22,11,27,5,27,5,22,5,17,5,12,
5,7,5,2
```

Bookshelf

QL software may be slow in appearing but there are books on the QL all over the place!

An Introduction to Programming The Sinclair

Often in the past I have extolled the virtues of books from the Babani publishing house. Their standard is a book that is concise, clear, written by someone who understands the subject well, and, at around £2.00, excellent value for money. Contributing to this success is a consistent style in which the salient points of the subject are described by example and supported by a brief discussion of their use followed by recommendations for development sufficient to encourage readers to investigate each and learn by themselves. Perhaps this style has been successful because until now the computers and subjects dealt with have lent themselves to a simplistic approach. The Sinclair QL is, by comparison, an advanced machine with, a complex computer language. So, can 'An Introduction to Programming the Sinclair QL' maintain both the form and style of earlier books? Does the more advanced machine not require a weightier tome?

If so, then the authors R.A. and J.W. Penfold do not realise it. The book is styled like the others: 100 pages divided into ten chapters. The text, as always, is supported by clear and simplistic line diagrams and program listings which while dumped to print by a low quality dot matrix printer are sufficiently legible.

The text tackles the instructions and functions of SUPERBASIC one at a time, reducing the complexity of the language to its most basic. Each chapter deals with a general area, beginning with 'Variables and Arrays' and subsequent chapters covering INPUT and PRINT, decisions, the sound generator, graphics, structured programming and interfaces. The authors are sufficiently confident that upon completion of chapters one to eight the reader will be mastering SUPERBASIC that chapter nine is dedicated to an introduction of elementary machine code.

There is little doubt that it is all here in the 100 pages between the covers, but I would dispute that a reader would be anticipating machine code after such a lesson. I found that most of the topics were glossed over often at such speed that many stood no chance of sinking in.

According to the cover notes, 'The authors adopt a step-by-step approach, starting with the fundamentals and then move on to more advanced topics'. But this really didn't seem to be the case, and though the cover notes also state that the reader should be able to write simple programs and then progresss on to more challenging things, I think that anything beyond the simplest of programs would present a challenge. This book is an account of BASIC — real basic BASIC, rather than SUPERBASIC. It will introduce the reader to the QL, but does not show how to program in SUPERBASIC, for there is nothing in the text to introduce or show how the advanced features of SUPERBASIC (as opposed to ordinary BASIC) may be used. It does not 'compliment the information supplied by the manufacturer', rather it ignores it. It is not a badly written book, and the format is still a good one, it is simply deficient, and so of little value.

'An Introduction to Programming the Sinclair QL' is published by Babani, written by R.A. and J.W. Penfold, and costs £1.95 (ISBN 0-85934-125-9).

The Sinclair QDOS Companion

Subtitled 'A guide to the QL operating system', this book is not intended as an introduction for beginners. The sleeve notes quite specifically describe the intended reader, for the book is aimed at those who want to understand the workings of the QL ROM (*which one? — Ed*) and this requires a full working knowledge of 68000/8 machine code.

Andrew Pennel, the author, also wrote 'Assembly Language Programming for the Sinclair QL', however, he has not simply rehashed that book but now takes a look at the QL's operating system with an emphasis on functionality rather than simple description. The book goes beyond the supplied operating manual to provide a broader understanding of QDOS and how to use it.

The one hundred and seventy pages are split into nine chapters, along with a number of appendices and index. There are chapters on multi-tasking, the second processor, and Interrupts, among others. Each chapters, along with a number headings detailing aspects of the topic under discussion.

Understanding the QL's operating system is no easy task, but the author has done well to keep each chapter in clearly defined and comprehensible sections, which are further clarified by the use of diagrams, tables, and examples where appropriate. Having said that though, readers will still require a knowledge of operating system principles and machine code as well as a few ideas on how they wish to use their knowledge in order to get the best from the book, and my only criticism of it is, that while concentrating on functionality it could also have given a few constructive suggestions on how to use all that knowledge.

'The Sinclair QDOS Companion' is written by Andrew Pennell, Published by Sunshine books, and is reasonable value for money at £6.95 (ISBN 0-940408-90-0).

Introducing The Sinclair QL

The Sinclair QL Series, published by Hutchinson, covers almost any event possible between a human and the latest machine to come from Sinclair Research (latest in that it is the most recent, not the most behind schedule). The range is unquestionably extensive, and personally I can't wait for 'Two Weeks Canal Boating With The QL'. There could be enough work in the series to keep me going for years, in the meantime though, 'Introducing The Sinclair QL' seems like a good place to start.

The format of the book can't be criticised. An enlarged table of contents guides the reader to individual subsections within each chapter, and there is an index for specific references, and a glossary to define some of the jargon-details that are too often overlooked by publishers, but which greatly enhance the value of a book.

A look at the contents page reveals that the main features of the QL — the bundled software and SUPERBASIC — make up the greater part of the book. The rest is simply an overview of the QL as it is, and as it could be extended, plus a bit on the keyboard and LOADing/RUNning programs. Skipping all this, I addressed myself to the subject of wordprocessing in the chapter 'What is a Wordprocessor?'. Now of course someone needs to know what a wordprocessor is for before they can use one, but I would have thought that anyone prepared to pay £400 for a computer would already have some idea of what one of its main uses would be.

Of the sixteen pages in this chapter, only four dealt with the specifics of using the Quill software, and, disappointingly, I found even these inadequate.

To be fair, the other chapters dealing with the bundled software were more reasonable, with the larger part of each chapter given over to instruction on how to use the software (although a fair amount of waffle was also present).

The book is intended for newcomers and experienced users alike-one of those well worn phrases which really means that the book is suitable for no-one specifically. Some of the information in the book is pertinent and useful, but equally, some is just waffle.

Introducing The Sinclair QL is published by Hutchinson Computer Publishing Ltd, written by Garry Marshall, and costs £6.95 (ISBN 0-9-158941).

Win A Sinclair Pocket TV!

```
D M R H A D D Y O P N H J B L K
H A F K E W Y R F H M O S L K Q
T E L W B C S O Z A S D T U H G
E E G L C B G N I J M E R E V H
D T Y M A R Y A R G L P C P D Q
I E W G H S B K T G T J M E A A
W E H V C X S C W R H I K T H L
N R G H J Y I A R A Y H N E U Y
O R F G H T H J I N K T H R B F
I F E J L S Y T G G R Q E Q F A
T Y W O G A N Y U E H D Z X F B
A G F D T N N L I H N G Y D C G
N D S F G Y R B H I K L O Q W A
E D H J U D E V M L R E A Q S F
J H G R W Q C B X L J L U T S H
K E R T R A T S R T N D R W H O
```

Tie breaker sentence ....

Name ....

Address ....

If you've ever wanted to watch the Wimbledon finals whilst sunning yourself on the beach at Margate, this could be your big opportunity. For, ever at the forefront of new Sinclair technology, ZXC has obtained one of Sir Clive's Flat Screen Pocket TV's which will go to one of our readers in this issue's competition.

The pocket TV is an amazing little device, the screen is only two inches wide, yet the quality of the picture is excellent and I've taken to lying in bed with it on Sunday nights, watching the season of Cary Grant films on Channel 4. In size, its a little thicker than the average paperback, but shorter, and *will* fit into a jacket pocket. Housed in a neat black case, the TV has its own aerial, and is powered by a flat Lithium battery pack, with an average life of some fifteen hours.

There are no contrast/brightness controls, as these and other functions are dealt with by a chip that monitors the state of the screen fifty times a second.



Tuning into individual channels is handled as on a radio, with a tuning dial covering a whole range of signal frequencies.

At first, when I showed the Pocket TV to a number of people, they all smiled condescendingly and said: 'Oh yes, it's very clever, but it's not really very practical. . . who would want to buy one. . . what would you use it for?'

However, when one of England's World Cup qualifying matches was shown on television one afternoon I suddenly found my desk surrounded by eager people who for some reason had changed their minds about the practical applications the Pocket TV (mind you, they still didn't get to see the match, as all the ZX team were watching Playschool at the time). If this catches on, I can see all of British industry grinding to a halt as people in offices all over the country sneak little televisions into their desks in order to watch Wimbledon, Snooker or Trumpton.

Anyway, as the Flat Screen TV is Sir Clive's contribution to television culture, we thought that our competition ought to be based upon some of the programs that you might be watching if you win the Pocket TV. Somewhere on this page is a wordsquare in which the titles of ten well-known TV series are arranged. The titles are listed horizontally and diagonally, both backwards and forwards. Just mark the titles on the square, and, as a tie-breaker tell us which particular porgram you would most like to watch on a Pocket TV, and why (in less than twenty-five words, of course).

The rules

- This competition is open to all UK and Northern Ireland readers of ZX Computing, except employees of Argus Specialist Publications, their printers and distributors, employees of Sinclair Research and anyone else associated with the competition. As long as each entry is sent on the proper form, there is no limit to the number of entries that an individual may submit.
- All entries must be postmarked before 30th September 1985. No correspondence will be entered into with regard to the results, and it is a condition of entry that the Editor's decision is final.
- The winner will be notified by post, and the result announced in a future issue of ZX Computing.

Light Screen Designer

Part 7

by
Toni Baker

This issue's article is all about drawing circles. I shall combine the circle drawing routine of last issue with a new routine given here. The new routine is called CIRCLE_THRU. Like CIRCLE_CENTRE, CIRCLE_THRU also draws a circle, but the difference between the two is that different parameters must be specified for the two routines. Take a look at figure 1 and you'll see what I mean. CIRCLE CENTRE is quite simple to program because it needs the same information as the ROM routine — the coordinates of the centre, and the radius (which you can work out if you know the coordinates of a point on the edge) — but CIRCLE_THRU needs three points on the edge.

I'm dwelling on the subject of drawing circles deliberately, not only because circles are interesting and magical shapes, but also because this is the first time that we've come across any difficult maths in the course of our programming. You see, it's actually quite difficult to find the coordinates of the centre (which is what we need), if all we're given is the coordinates of three points on the edge. Think about it for a bit and see if you can come up with an easy solution.



```
                                ORG E0BD
180A                            JR CC_MOVE
C5          CIRCLE_CENT         PUSH BC
CDA0E0                          CALL E0A0,GET CURSORS    Store cursor coordinates
                                                         in calculator memories.
CDC9E0      CC_FIN              CALL E0C9,CIRCLE_ARGS    Calculate parameters
                                                         for CIRCLE ROUTINE
CD2D23                          CALL 232D,CIRCLE_1       Draw circle.
C1          CC_MOVE             POP BC                   BC=cursor coordinates.
CD41DD                          CALL DD41,PIX_ADDR       HL=cursor position.
C3F3DE                          JP DEF3,MOVE             Move Origin.
21925C      GET_CURSORS         LD HL,MEMBOT
22655C                          LD (STKEND),HL           Point calculator stack
                                                         into memory.
210CD8                          LD HL,ORIGIN
1E03                            LD E,03                  E=number of cursors.
  23        GC_LOOP             INC HL
  23                            INC HL
  4E                            LD C,(HL)
  23                            INC HL
  46                            LD B,(HL)
  23                            INC HL
CDEADE                          CALL DEEA,ADJUST_B       Adjust to ROM convention.
  E5                            PUSH HL
  D5                            PUSH DE
  C5                            PUSH BC
  78                            LD A,B
CD2B2D                          CALL 2D2B,STACK_A        Stack y-coordinate.
  C1                            POP BC
  79                            LD A,C
CD2B2D                          CALL 2D2B,STACK_A        Stack x-coordinate.
  D1                            POP DE
  E1                            POP HL
  1D                            DEC E
20E6                            JR NZ,GC_LOOP
CDC516                          CALL 16C5,SET_STK        Restore calculator stack.
  C9                            RET
  EF        CIRCLE_ARGS         RST 28                   Engage the calculator
  E1                            recall M1                Ox

  E0                            recall M0                Ox,Oy
  31                            duplicate                Ox,Oy,Oy
  E4                            recall M4                Ox,Oy,Oy,Cy
  03                            subtract                 Ox,Oy,Oy-Cy
  31                            duplicate                Ox,Oy,Oy-Cy,Oy-Cy
  04                            multiply                 Ox,Oy,(Oy-Cy)^2
  E1                            recall M1                Ox,Oy,(Oy-Cy)^2,Ox
  E5                            recall M5                Ox,Oy,(Oy-Cy)^2,Ox,Cx
  03                            subtract                 Ox,Oy,(Oy-Cy)^2,Ox-Cx
  31                            duplicate                Ox,Oy,(Oy-Cy)^2,Ox-Cx,Ox-Cx
  04                            multiply                 Ox,Oy,(Oy-Cy)^2,(Ox-Cx)^2
  0F                            add                      Ox,Oy,(Oy-Cy)^2+(Ox-Cx)^2
  28                            sqr                      Ox,Oy,radius
  38                            end calc
  C9                            RET
```



Imaginary lines

The method I've used involves drawing an imaginary line halfway between the Origin and the Marker, and another line halfway between the Cursor and the Marker — where the two lines cross is the centre of the circle.

The algorithm can be easily demonstrated with the BASIC program in figure two. We shall later see how to translate this algorithm into machine code.

You see, the algorithm works out the point where the two imaginary lines cross. It turns out that the equations of the two lines are:

$$Ax + By = C$$
$$Dx + Ey = F$$

where A,B,C,D,E and F are defined as above. From line 170 to 200 the program concentrates on finding values of x and y which solve both equations.

Before I list the program, I'd like to point out — and, of course, to cure — a bug which cropped up earlier in LSD. At address DDDD, the instruction CALL SET_MIN minimises all of the workspace — the calculator stack and so on. Unfortunately, it also clears the edit-line, so that the current command is destroyed. This can sometimes cause the error 'C:Nonsense in BASIC'. To cure the error, I propose to CALL SET_WORK instead, which leaves the edit-line untouched. So, to cure the bug type the following BASIC command:

POKE 56798,191

Now for the program: note that I start from a new version of the CIRCLE_CENT routine in order to make economic use of subroutines.

Only one address in the Command Addresses Table needs to be changed. It is:

DB4E: 30 E1 — DEFW E130, CIRCLE_THRU

```
                        ORG E0DA
EF        MATRIX        RST 28
E2                      recall M2          My
31                      duplicate          My,My
04                      multiply           My^2
E0                      recall M0          My^2,Oy
31                      duplicate          My^2,Oy,Oy
04                      multiply           My^2,Oy^2
03                      subtract           My^2-Oy^2
E3                      recall M3          My^2-Oy^2,Mx
31                      duplicate          My^2-Oy^2,Mx,Mx
04                      multiply           My^2-Oy^2,Mx^2
0F                      add                My^2-Oy^2+Mx^2
E1                      recall M1          My^2-Oy^2+Mx^2,Ox
31                      duplicate          My^2-Oy^2+Mx^2,Ox,Ox
04                      multiply           My^2-Oy^2+ Mx^2,Ox
03                      subtract           My^2-Oy^2+Mx^2-Ox^2
A2                      const half         My^2-Oy^2+Mx^2-Ox^2,1/2
04                      multiply           C
E2                      recall M2          C,My
E0                      recall M0          C,My,Oy
03                      subtract           C,A
C0                      store M0           C,A
02                      delete             C
E3                      recall M3          C,Mx
E1                      recall M1          C,Mx,Ox
03                      subtract           C,B
C1                      store M1           C,B
02                      delete             C
38                      end_calc
C9                      RET
```

```
                           ORG E0F8
CDDAE0    CALC_CENTRE      CALL E0DA,MATRIX     Calculate A,B and C
FD362E9C                   LD (MEM),9C
CDDAE0                     CALL E0DA,MATRIX     Calculate D,E and F
FD362E92                   LD (MEM),92
  EF                       RST 28               C,F
  C4                       store M4             C,F
  02                       delete               C
  C5                       store M5             C
  02                       delete
  E1                       recall M1            B
  E2                       recall M2            B,D
  04                       multiply             B*D
  E0                       recall M0            B*D,A
  E3                       recall M3            BD,A,E
  04                       multiply             BD,AE
  03                       subtract             Det
  31                       duplicate            Det,Det
  30                       eq Z                 Det,Det=0
 0017                      jump_true,NOT_POS    Det
  31                       duplicate            Det,Det
  E5                       recall M5            Det,Det,C
  E2                       recall M2            Det,Dët,C,D
  04                       multiply             Det,Det,CD
  E0                       recall M0            Det,Det,CD,A
  E4                       recall M4            Det,Det,CD,A,F
  04                       multiply             Det,Det,CD,AF
  03                       subtract             Det,Det,CD-AF
  01                       exchange             Det,CD-AF,Det
  05                       divide               Det,X
  01                       exchange             X,Det
```

```
E1                      recall M1          X,Det,B
E4                      recall M4          X,Det,B,F
04                      multiply           X,Det,BF
E5                      recall M5          X,Det,BF,C
E3                      recall M3          X,Det,BF,C,E
04                      multiply           X,Det,BF,CE
03                      subtract           X,Det,BF-CE
01                      exchange           X,BF-CE,Det
05                      divide             X,Y
38                      end_calc
C9                      RET
38        NOT_POS       end_calc
E1                      POP HL             HL=return address.
C1                      POP BC             BC=cursor coordinates.
E9                      JP (HL)            return from subroutine.
```

```
                          ORG E130
CD22E0    CIRCLE_THRU     CALL E022,TEST_MARKER
  C5                      PUSH BC
CDA0E0                    CALL E0A0,GET_CURORS   Get cursor coordinates
                                                 into calculator memories.
  EF                      RST 28
  E4                      recall M4              Cy
  E5                      recall M5              Cy,Cx
  38                      end_calc
  CDF8E0                  CALL E0F8,CALC_CENTRE  Calculate the centre
                                                 of the circle.
  EF                      RST 28
  C0                      store M0               M0=y
  02                      delete
  C1                      store M1               M1=x
  02                      delete
  C5                      store M5               M5=Cx
  02                      delete
  C4                      store M4               M4=Cy
  02                      delete
  38                      end_calc
CD38DF                    CALL DF38,CANCEL_MARK
C393E0                    JP E093,CC_FIN
```

```
10 INPUT "Ox=";Ox
20 INPUT "Oy=";Oy
30 PLOT Ox,Oy
40 INPUT "Mx=";Mx
50 INPUT "My=";My
60 PLOT Mx,My
70 INPUT "Cx=";Cx
80 INPUT "Cy=";Cy
90 PLOT Cy,Cx
100 PAUSE 0
110 LET A=My-Oy
120 LET B=Mx-Ox
130 LET LET C=(Mx*Mx-Ox*Ox+My*My-Oy*Oy)/2
140 LET D=Cy-My
150 LET E=Cx-Mx
160 LET F=(Cx*Cx-Mx*Mx+Cy*Cy-My*My)/2
170 LET DET =B*D-A*E
180 IF DET=0 THEN PRINT "Circle not possible":STOP
190 LET X=(C*D-A*F)/DET
200 LET Y=(B*F-C*E)/DET
210 LET Rx=Cx-X
220 LET Ry=Cy-Y
230 LET RADIUS=SQR(Rx*Rx+Ry*Ry)
240 CIRCLE X,Y,RADIUS
```

Figure 2.
Demonstration of algorithm.

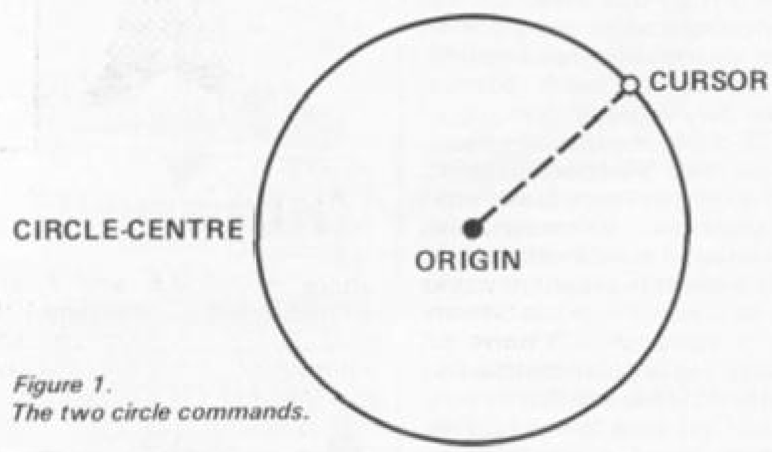
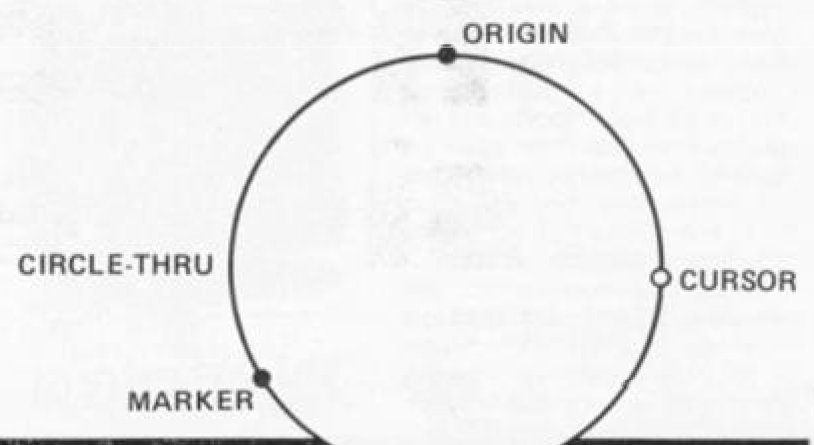


Figure 1.
The two circle commands.





Budget Software



A look at some cut price software for the Spectrum.

Firebird

Firebird, the BT company who made such an impact with their first collection of SW have added to their range with the introduction of seven new programs in their Silver, £2.50, series.

FAHRENHEIT 3000 was originally a full priced program from the Softstone company and is a platform style game. Though nothing special it is a fair effort, and good value for money if you are a fan of this type of game.

DON'T PANIC is a variation of the Jet Pac/Astronut game where you have to load a spaceship with items found on various levels of the playing screen. I found this one quite addictive and very playable (*So did I — Ed's Assistant*).

HELICHOPPER is a bomb and dodge game which again is very enjoyable and good value, though as with all these games, the quality reflects the price to a certain extent.

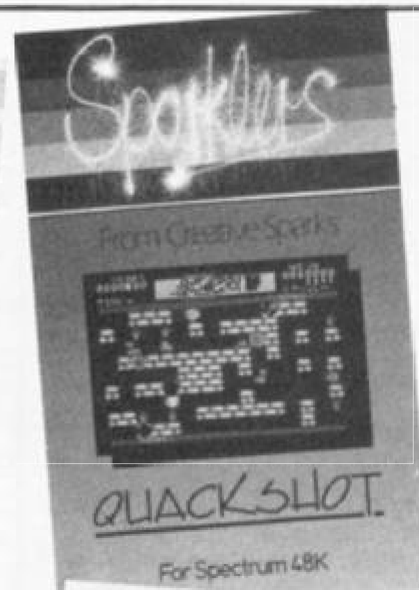
SHORT'S FUSE is a simple but maddeningly addictive game in which you have to chase around the screen to reach bombs before they explode.

SUBSUNK is a graphic adventure in the standard format which presents many brain teasing puzzles, although not outstanding it is well written and is comparable to programs being sold at twice the price. Worth adding to your collection if adventuring is your forte.

THE HELM is another adventure but this time text only. This program found a place in my heart for the lovely tongue in cheek approach which it adopts. Humour is a matter of preference but I found myself playing over and over again to discover what other comments the programmer had included. Nice one Simon Jay, highly recommended!

From the sublime to the ridiculous, DON'T BUY THIS is a collection of some of the worst games sent to Firebird. Definitely not recommended unless you want to see how NOT to write a program! All in all, apart from the last one, the Firebird range provides good value and a wide selection — I wish I'd bought shares in BT.













Creative Sparks

QUACKSHOT is the first release that we have received from the new £2.50 "Sparklers" range.

This is quite a respectable maze, chase, and shoot 'em up game which kept me busy for some time. It is just as good as the earlier releases which were full priced. You are chased through a maze-like factory by beserk ducks, and there are also similarities to Tutenkamen, the old arcade game.

I liked it and say welcome to the market to Sparklers and hope we see more.

Mastertronics

The grand old masters of budget software are still active and still keeping prices to £1.99. We've seen two new programs from them, both aimed at the younger user, but this should not deter more mature gamesters from looking at them.

HOTCH POTCH is a sliding block puzzle type game which has nice bright and colourful pictures. Perhaps this is the least interesting of the two and is aptly aimed at youngsters. Shape and position is helped as an educational aid. Not bad, but not very exciting.

TYPE ROPE is a simple game where a picture is drawn of the cute character who is tied up with ropes. The ends of these ropes are attached to pegs marked with a letter or number, by pressing the connecting letters/numbers the rope is released and you have to free the character before time runs out. This is a simple game based on the "trace the path" puzzles found in many children's comics. With the time element and the well judged difficulty levels this game can be enjoyed by all ages. I liked it.

Give my regards to BROAD STREET



Or better still, give your regards to Paul McCartney himself, for that's the chance we can offer you in this great competition — the chance to meet Paul McCartney in his London studio and spend some time with him playing the 'Broad Street' game!

This competition has been organised in conjunction with Computer Gamer magazine, Your Commodore, Home Computing Weekly, and Personal Computing Today, and in addition to all the prizes on offer, we can also offer you a special coupon which will save you £1 when you buy Broad Street direct from its publishers.

The prizes

The full first prize is as follows: a second class return trip to London for the winner (and an adult if the winner is under sixteen years old), plus lunch and then the meeting with Paul McCartney in his studios.

In addition, we also have a large number of runners-up prizes, consisting of:

Six copies of the 'Broad Street' video.
Six copies of the 'Broad Street' album.
Fifty prizes of £10 worth of software from the Argus Press software range.

The closing date for the competition is August the ninth, so don't hang about — get your entries in right away!



This is your big chance to meet Paul McCartney himself! All you have to do to enter the competition is to write the answers to the questions in the spaces provided below. Once you've done that, just send the coupon to:

ZX Computing, Broad Street Competition, 1 Golden Square, London W1R 3AB.

Question 1) . . . .
2) . . . .
3) . . . .
4) . . . .
5) . . . .
6) . . . .
7) . . . .
8) . . . .
9) . . . .

Name . . . .

Address . . . .

£1 OFF!

Plus . . . not content with giving a great competition, we're also giving you this special coupon worth £1 off the cost of the Broad Street game (Spectrum version, of course), allowing you to buy if for just £6.99!

Just send this coupon and payment of £6.99 to:

Argus Press Software, Broad Street Offer, Liberty House, 222 Regent Street, London W1.

The competition

All you have to do to enter, is answer the following questions about the game:

1) How many people are there in the game?
2) What make of car does Paul drive in the game?
3) Where do you go after you've collected the missing notes?
4) What tube station does George Martin come out of after landing in Heathrow?
5) In the game, which tube station shows you the Tower of London?
6) Which tube station do you go to, to visit the Old Justice Pub?
7) What is your high score on the game?
8) What time of day did you finish?
9) What was the last tube station Sandra went through?

Don't worry about question 7, this isn't a high-score competition, it's just that Argus Press Software want to know how you all did on the game.

The rules

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- All entries must be postmarked before the ninth of August, and sent to the editorial address.
- No correspondence will be entered into with regard to the results, and it is a condition of entry that the Editor's decision is final.
- The winners will be notified by post, and the results published in a future issue of ZX Computing.
- Entries must be on the coupon provided, but as long as each entry is on the proper coupon (no photocopies accepted), there is no limit to the number of entries by each individual.

We the jury . . .



STARION
Melbourne House
£7.95

Starion just missed the last issue by the skin of its teeth but as it was so good we thought we'd include it in this issue, even if it is now a couple of months old.

In the year 2010 you are sent back in time to correct the disturbances caused by a race of time travelling aliens. There are 243 time zones to visit and in each one you have to battle with an enemy fleet.

On destroying an alien ship a letter of the alphabet is released and you have to collect it. When you have collected nine letters you have an anagram to solve in order to answer a historical question from another time zone. Once you've worked through all 243 zones you arrive at Event Zero and earn the title of 'Creator'.

Melbourne House have obviously decided to produce a program to compete with Elite on the BBC and in many ways they have done just that. The graphics are perspective vector type but the movement is truly superb, it takes a lot to make an impression on us battle hardened reviewers but we *were* impressed!

Flying and fighting is a skill in its own right, the techniques are nearly as complicated as in full flight simulation programs — often I spent time locating and chasing an enemy only to see him zoom past as I failed to slow down and match speeds in time. Two scanners are provided to assist you and sound is up to the Spectrum's usual standard. A Classic!

GRAPHICS * * * * *
ADDICTIVENESS * * * *
OVERALL * * * * *

CONFUZION
Incentive
£6.95

This is the most annoyingly addictive game we tried in this batch of programs! OK, so it doesn't have state of the art graphics, speech, prizes, or any other worthy selling point, but it deserves a place in the charts for its sheer ingenuity and compulsive playability. I dare not load it in because it means the end of any work for a few hours.

The idea on which it is based is a very old one, the sliding block puzzle, the twist is the movement within the block and the all too short time in which to find a solution. You have a grid of blocks, the number and shape depends on the skill level, in which is a track along which a spark constantly travels. By moving the blocks to create new track paths you have to guide the spark to the confuzion bombs at the sides of the screen before they explode.



On some of the 64 screens there is also the added hazard of water drops travelling along the tracks, contact means loss of a spark. A wide variety of options and a well balanced playing level makes it easy to start playing and difficult to stop.

In print it may not sound particularly interesting, but I urge you to try it for yourself at your nearest dealer.

GRAPHICS * * * *
ADDICTIVENESS * * * * *
OVERALL * * * * *

TAPPER
US Gold
£7.95

This is a competent arcade game from Bally Midway/Sega, which is a thinly disguised standard action program.

Actually, it is quite absorbing as many simple ideas are; you are a bartender and your job is to serves customers their drink by sliding it along the counters which run towards you. There are four of these counters, in different positions as the difficulty progresses, and the customers move towards you. Quite simply it is a case of moving up and down sliding glasses of drink to the customer. However they come in different groups, and you mustn't put too many drinks down, nor can you miss any empty glasses which a customer may send back.

Should you clear the room by serving all the customers then a "find the lady" type game is played for bonus points. Bonus points can also be gained by collecting tips.

This is a nicely presented game (albeit a little on the expensive side), with some good options at the start such as define playing keys and a request to "sign on", the graphics are pretty good but some movements are a little jerky. Play is nicely graded so that you can start playing quickly and achieve a score and then want to improve it. I didn't like the high score table starting at 10000 as most of my early attempts were just below this, however once I did get in I admit to feeling pleased with my efforts.

GRAPHICS * * * *
ADDICTIVENESS * * * *
OVERALL * * * *



CHARLIE AND THE CHOCOLATE FACTORY
Hill MacGibbon
£9.95

An interesting package based o[n] Roald Dahl's popular book of th[e] same name. The tape has a di[f]ferent program on each side side one being a program whic[h] consists of four arcade game[s] and on side two is what the[y] describe as "a multi-screen a[r]cade adventure".

When side one has loade[d] you have the choice of playin[g] any of the four games in practi[ce] mode, ie. you play them as no[r]mal but your scores do not g[o] towards getting the code nee[d]ed to play the game on side tw[o]. This is quite a good idea as [it] means that you can practis[e] each section until you are rea[dy] to attempt all four sections in se[]quence to try for the elusiv[e] code.

These games are [a] reasonable and provide goo[d] though not very sophisticate[d] entertainment. They are qui[te] difficult to master and a joystic[k] does help a lot. Side two pr[o]vides a longer, 43 roomed pla[t]form type game. This can b[e] played without the code fro[m] side A but the six keys whic[h] you have to find to complete th[e] game will not be there. Howev[er] you do get infinite lives and [a] chance to explore the room[s] before undertaking the fin[al] task. I found that I enjoyed pla[y]ing these games but lacked th[e] inspiration to go for the ultima[te] solution. Not bad if you consid[er] it to be a pack of cut pric[e] games.

GRAPHICS * * *
ADDICTIVENESS * * *
OVERALL * * * *

BATTLE FOR MIDWAY
PSS
£4.95

Here is a strategy game of som[e] complexity. Presented in a[n] unusual ring binder containin[g] the tape in a pouch and the te[n] page manual/booklet, it ha[s] been impressively packaged.

The booklet is well writte[n] and produced and takes the tim[e] to explain and show you ho[w] best to play the game. There a[re] three levels and level one is use[d] to learn the game. Level two [is] the actual simulated condition[s] and level three adds a few ext[ra] problems. The graphic represe[n]

tation is perfectly adequate for the game and the selection and number of controls are kept to a minimum. Essential operations can be controlled by joystick.

Your task is to stop the Japanese fleet from invading Midway and to sink as many of their aircraft carriers as possible. You have three main aircraft carriers to use. Your first job though is to locate the enemy ships, then you have to keep on attacking them until they are sunk. Sinking the four Japanese carriers will win the game.

This is not an easy game to win (except for level 1) and I would think that experienced wargamers will enjoy the challenge this game provides and the novice will find it an easy game to begin with as long as he is able to cope with initial frustration!

GRAPHICS ***
ADDICTIVENESS ****
OVERALL ****



ARCHON
Ariolasoft
£10.95

This is the game I've been waiting for ever since I saw the 3D laser game played by Chewbacca and R2D2 in Star Wars! Of course it isn't 3D laser, and who knows what the name or rules of the film game was, but this is what I imagined it to be like.

Essentially you have two forces, either human or computer controlled, black and white, lined up against each other on a chess style board of 9x9 squares. Some of these squares change colour as the game progresses and the closer it is to your colour the more power you get from it. Five squares have flashing power points. Each member of each force has their own strengths, weaknesses and movement allowance and you attack an opponent by moving onto their square. Once you move onto an enemy square the game changes to a simple dodge and fire arcade sequence. Although the outcome is likely to be in favour of the most powerful piece there is always an outside chance of pulling off an upset. Strategy is an important factor in this game and the aim is to capture or control all the power squares.

The graphics are a little indistinct and the manual is not as simple as it could have been, but it is worth persevering with the manual, and you soon get used to the graphics.

Archon is a game that takes a while to grasp but which will be played long after most others will have been forgotton.

GRAPHICS ****
ADDICTIVENESS *****
OVERALL *****

TRANSFORMER
A.C.S. Software
£9.95

Transformer enables you to transfer most of your exciting software on to a microdrive cartridge. When the program has loaded, it automatically saves itself onto microdrive. This can be awkward if you forget to erase it before transfering your programs, however using it from the microdrive gives no problems.

Using this program is very simple, select the program you wish to transfer from the menu and play your original tape. Transformer automatically saves it on to microdrive and then re-loads it from microdrive to check it has transferred successfully.

Here is a list of some games that are guaranteed to transfer: Ghostbusters, 3D Starstrike, Zip Zap, Underwurlde, Beach-Head, Zzoom, Decathlon, Pole Position, Pyjamarama, Knightlore, Monty Mole, Project Future, Twin Kingdom Valley, Atic Atac, Trashman, Sabre Wulf, The Hulk, Pssst, Codename Mat, Jetpac, Transam, Cyclone, Manic Miner, Jet Set Willy.

No knowledge of programming is needed at all, and when we tested Transformer with half a dozen of the programs mentioned all transferred without any problems.

This type of program is often abused, either with the maker's consent or not, but we feel that the company are genuine in their intent to produce an aid for microdrive owners and have tried to discourage the misuse of the program as much as possible.

GRAPHICS N/A
EASE OF USE ****
OVERALL ****



GIVE MY REGARDS TO BROAD STREET
APS Ltd.
£7.99

For those of you that don't look up from your computer screens very often, the title of this program is taken from a film made by Paul McCartney, and he approved this game. Some unkind person said that judging by the ▶

film that was no recommendation but we don't believe in repeating vicious gossip!

Actually, whatever your opinion of the film, this game is very good and deserves your attention. The game comes well packaged in a large presentation box, and you are supplied with a map and mini biographies of the characters. These are important as you have to track down all seven to retrieve the ten lost chords before midnight, or you join the buskers.

The display is in three main sections, the top being an animated arcade screen around which you guide your Ford Prefect car, as you drive around to the tube stations trying to locate your band. As each member leaves home you are told and, knowing the time of day and their personal habits, you have to try and drive to the tube station they will exit from.

The graphics are colourful and informative and are animated well, they may not be "state of the art" but they work well and provide satisfactory realism.

Another game for those who like to think fast while playing a furious arcade game. Recommended.

GRAPHICS * * * *
ADDICTIVENESS * * *
OVERALL * * * *



JONAH BARRINGTON'S SQUASH
New Generation Software
£7.95

Yet another sports simulation but this one, for one or two players, gives you the pleasure of actually hearing the scores as the machine annihilates you.

Well sort of. The idea is good and if you listen carefully enough you can make out the words but I'm afraid the Spectrum sound system has defeated yet another brilliant programming feat. When connected to a tape recorder the quality did improve, the DK sound box helped even more but even at its best it sounded like a Dalek with a sore throat.

But apart from that, this game would be a winner without the speech. It's fast, furious and, with clever, well animated graphic characters, the game is all an armchair Squash player could desire.



The action screen is set on the left in 3D perspective graphics and by careful positioning and choice of angle, learnt only after much practise, a level of control can be achieved. A wide range of options are offered, one/two player, keyboard or joystick and four levels of difficulty.

Full instructions are provided, which was useful as I have so far managed to avoid offers from healthy individuals to have a go and so I had never played before. I know of the game's reputation though and I reckon it's the only game I know to extend realism to the extent of causing a cardiac arrest.

GRAPHICS * * * * *
ADDICTIVENESS * * * *
OVERALL * * * *

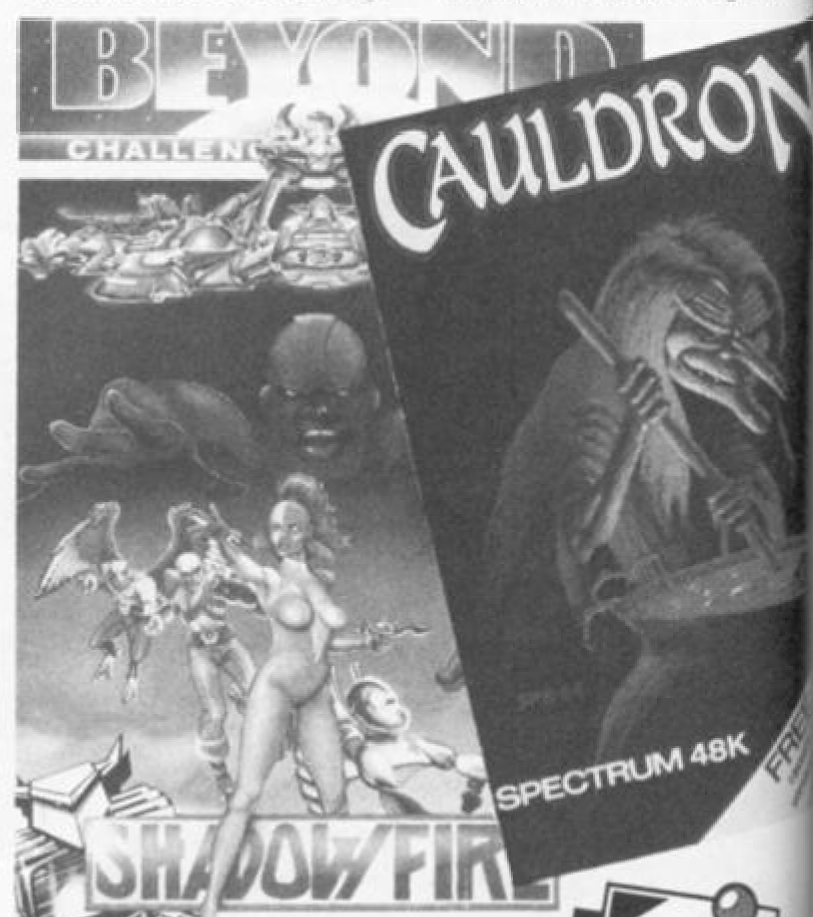


SHADOWFIRE
Beyond
£9.95

Well, we've seen text, multiple choice, graphic, animated, filmation, and all the combinations of each but this is the first ICON driven adventure to date.

Icons are little pictures which represent objects or actions and has been used for business software on the larger machines for some time now. Control of the game is simplified to five keys or a joystick and quite complex instructions can be entered by this means, however, as with all things worthwhile, some time has to be spent learning to use the system. Beyond make this relatively painless with their colourful and well produced manual.

The task you are set is to rescue Ambassador Kyrxix who has the secret plans for a revolutionary starship called Shadowfire, capture General Zoff, the baddie, who is holding Kyrxix captive aboard his skyfortress Zoff V which you must also capture or destroy.



A doddle? Well, not really, you only have 100 minutes to do the lot! Still, you do have control of all six weird, wonderful and talented members of the Enigma team.

But back to the Icon system. To give an example, use the *joystick to select a character by* moving the cursor to him/her/it, and press fire. That character's personal details are then shown on screen. Move the cursor to the "pick up" Icon and select, move the cursor to an object, press fire and the object will have been picked up by that character. His possessions table will show the extra object and his agility, stamina and strength will be affected accordingly. Operations are as simple as that, the game itself is very complex, Beyond recommend that you read the manual briefly, I recommend you read it in detail and very carefully. Brilliant!

GRAPHICS * * * * *
ADDICTIVENESS * * * *
OVERALL * * * * *



Cauldron
Palace Software
£7.99

Usually games converted from the CBM64 to our beloved Speccy, don't fare too well. However, having played the '64 version of Cauldron (against my will, you understand) I actually think that the Spectrum version *is better.*

Of course, the attribute problems are there as always, but I found that controlling the figure of the Hag, as she flies around on her broomstick, was much easier on the Spectrum than on the '64.

You have eight hags available, and must fly them over a scrolling landscape of forests, mountains, seas and cemeteries, from which appropriate nasties issue forth in order to drain your magical

reserves. Hidden within the landscape are four keys which provide access to the underground depths through which you must wander to find the Pumpking's Lair.

Personally, I found flying the Hag on her broomstick the most enjoyable part of the game. She is well animated and really pretty nippy on her broomstick, and she can also fire bolts at the ghosts, bats etc. which attack her. Unfortunately, once you get underground the game becomes a sort of Jet Set Hag clone. Normally that wouldn't bother me, but I actually found some of these screens irritating since there's no real indication of where you should be going. So, often, when you have bounced your way across a screen, there is no way of knowing how to get onto the next screen and you simply have to leap blindly in the hope that you may land on something in an adjacent screen. So far though, I have virtually always failed to cross between screens safely and this rather haphazard way of doing things becomes irritating as you lose all your Hags in a matter of seconds through no fault of your own.

Cauldron is quite enjoyable on the whole, but I do wish that it had been designed a little more carefully. Mind you, the flip side of the tape has a free Spectrum version of Palace's Evil Dead on it, which is a nice bonus and makes Cauldron good value for money.

GRAPHICS	* * * *
ADDICTIVENESS	* * * *
OVERALL	* * * *











Nodes of Yesod
Odin Computer Graphics
£9.95

Looking at the packaging and glossy, Ultimate style instruction booklet, I was expecting 'Nodes' to be simply over-hyped and underwhelming, as so many 'mega-games' have proved to be.

However, I was pleasantly surprised by Nodes once I started playing, and spent the best part of an evening bouncing around the surface of the moon and trying to complete the game.

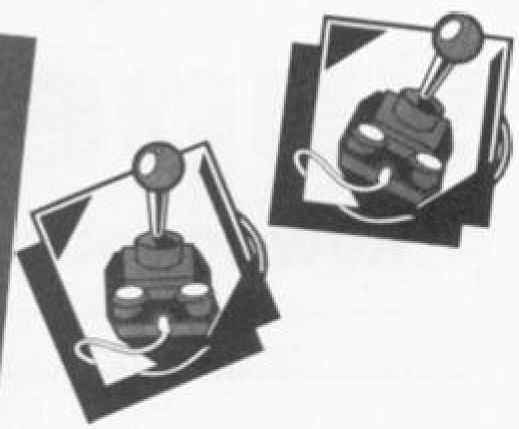
In many ways, Nodes is simply a platform-collect-the-object game, but it is nonetheless a very good one, and well enough designed to keep you interested in it for a long time.

You play the part of the Rt Hon Charly Fotheringham-Grunes, 'apprentice saviour of the universe', and must guide him through caverns in the depths of the moon, in search of a monolith which is transmitting signals to another planet. To aid you in your search, you can recruit an extremely cute and nicely animated moon-mole, who can eat through moon rock and sometimes discover new passages and caverns.

The figure of Charly himself is also very well animated — a large sprite, that actually seems to have a real character, and which somersaults delightfully, rather than just hopping across the screen. His somersaults are some of the smoothest animation I have yet seen on the Spectrum, and I spent a long time just bouncing around in order to enjoy the quality of the animation. As usual, there are various monsters out to stop him from reaching his goal, but here again his friendly moon-mole can help, by running around and eliminating them.

Nodes isn't really state of the art, but it is a very well designed game and very enjoyable. My only criticism is that at £9.95, it's rather expensive, though not outrageously so.

GRAPHICS	* * * *
ADDICTIVENESS	* * * *
OVERALL	* * * *



Dun Darach
Gargoyle Software
£9.95

I suspect that I've only scratched the surface of Dun Darach, but I'm already hooked, and I'm probably going to be spending a lot of time wandering the streets of Dun Darach, in the guise of Cuchulain, for a long time to come.

Cuchulain, last seen in Gargoyle's excellent Tir Na Nog, is now in search of his comrade Loeg, who is being held captive in the town. One of the great features of this game is that although you are faced with that one task, there is no set solution to it, and so you are free to wander the town and try and get on with its inhabitants in whatever way you wish.

The playing area of the town is very large, and populated by a number of characters, some of whom simply stay put in their shops, whilst others are more active and take to the streets (and seem to spend most of their time robbing me blind while they're at it).

The graphics, as in Tir Na Nog, are excellent, with the large figure of Cuchulain very smoothly animated so that it's a pleasure just to see how he responds to your controls. The graphic style that Gargoyle have developed may lack the 3-D perspective of Ultimate's games, but the quality of the animation and the size of the figures make their style an equally attractive alternative, and a strong contender for the 'computer cartoon' throne.

That, plus the richly imaginative and detailed background to the game (the manual actually lists a number of works that helped with the mythological background), makes Dun Darach an absorbing and satisfying game for anyone that wants to do more than simply zap aliens.

GRAPHICS	* * * * *
ADDICTIVENESS	* * * * *
OVERALL	* * * * * *

Superbubble

How to speed up list-sorting by John Kinory

One of the tasks at which computers are most efficient, is the sorting of information, such as names or numbers, into a definite order. Such sorting involves carrying out repetitive, simple steps of comparing two items. Although each step has to be repeated many times — depending on the length of the original list and how disordered it was to begin with — the speed of the computer in performing simple calculations and comparisons ensures that the list will be sorted in a reasonable time.

It comes as a surprise to see just how much work is involved in sorting even a list of modest length. Nonetheless, computers are routinely used in ordering lists with thousands of items.

There are many different sorting routines, and most can be adapted for a micro. The execution-time will depend on two properties of the sort:

1. The simplicity of each repeated loop.
2. The number of repetitions necessary for a given length of list.

The power of the computer being used is also of some relevence!

Bubblesort

One of the most popular routines is Bubblesort: although by no means among the fastest, it is very easy to program.

What happens is quite simple. The items to be sorted — let's say numbers — are held in a numbered array as is usual in such schemes. The program only has to compare two adjacent numbers at any time, and swap them around if they are in the wrong order.

Listing 1 shows the standard Bubblesort:
Lines 10-40 define the array (here with 100 elements), and read the numbers to be sorted.
Line 50 sets a flag, indicating when the sorting is complete.
Lines 60-80 do the sorting, and reset the flag.
Line 200 checks the flag, and continues or terminates the routine.

The program has to make repeated passes along the array, swapping adjacent elements which are still misplaced. As long as any swaps are made in the pass, at least one more pass will be made.

Table 1 shows the results of successive swaps, made in the first two passes on a list with five elements. The name of the routine should now be self-explanatory: the larger numbers "bubble" forward through the array, until they reach their "proper" level.

Table 1

Array element	1	2	3	4	5
Original list	31	16	25	12	7
PASS 1	[16↔31]		25	12	7
	16	[25↔31]		12	7
	16	25	[12↔31]		7
	16	25	12	[7↔31]	
PASS 2	16	[12↔25]		7	31
	16	12	[7↔25]		31

Shortcomings

The routine is very simple and reliable; it is also rather slow. A one hundred-item list typically takes about three minutes to sort on the Spectrum, if it is completely random to begin with. The reason is the large number of passes that have to be made. If you are unlucky, you will need 100 passes for the above list, a thousand passes for a 1000-item list, and so on. In the latter case, the 1000 comparisons made per pass also slow each pass by a factor of 10.

Superbubble

When comparing various sorting routines one day, it occurred to me that one of the reasons for the slowness of Bubblesort is that it only "percolates" one way. If you look at table 1 you will see that one can guarantee that the largest item will be sorted in the very first pass. This is because whenever it moves along one place, it is immediately caught by the incremented FOR-NEXT loop, and moves again.

By contrast, small numbers move back much more slowly. In fact, they do not bubble actively, but are merely pushed back by a larger number changing places with them. They can thus move at most one place every pass. That means that the smallest number in the list *could* take as many passes as there are elements in the array to reach its correct place. If the only disorder in the list happens to be one small number too far along, then a large number of passes, and certainly the many comparisons made in each pass are wasted effort.

In a general Bubblesort, the average time taken to complete the job is proportional to k, where there are k items to be ordered.

I decided to modify Bubblesort (resulting in Superbubble), by performing *two* consecutive passes in each cycle, one percolating down the array and the other propagating back up. This allows items to move up as fast on the return pass, as they can move down on the forward pass. To implement this add the lines in Listing 2.

Testing

To check this idea, I ran both programs many times on the Spectrum 48K. Within each comparison (i.e. one run on each version), I used the SAME numbers in the SAME starting order. Both the numbers and their order, however, were generated randomly for each pair of runs, to ensure that there was no bias in favour of either routine. Timing instructions, using the Spectrum internal clock, were added to each program. These do not effect the run time. In addition, counting the number of passes made, slowed both programs by about 2.5%. The results are summarised in tables 2 & 3.

Several things stand out:

Table 2

		BUBBLESORT					SUPERBUBBLE				
No. of items	No. of runs	mean time(s)	range (s)	mean No. of passes	range	mean time per pass*) (s)	mean time(s)	range (s)	mean No. of passes	range	mean time per pass*) (s)
50	10	45	40-48	44	37-49	1.0	33	28-37	27	22-30	1.2
100	10	183	166-198	91	82-96	2.0	132	119-169	54	48-70	2.4
200	6	722	680-759	180	166-188	4.0	510	469-546	102	92-110	5.0

*) Calculated from the individual passes, NOT from previous means.

1. The number of passes that Superbubble needs to take (in both directions) has dropped dramatically. Whereas Bubblesort makes nearly as many passes as there are items; Superbubble makes just over half that number.

I am sure it is possible to analyse mathematically what is happening, and prove that there is some upper limit (less than k, hopefully . . .) to the number of passes Superbubble requires. I shall leave this to someone else, and simply rely on the tabulated statistics.

Although there is no guarantee this trend will always hold true, it seems to be a general feature. Only very few runs exhibited large deviations, due to some peculiarity in the list. In no case was Superbubble *less* efficient.

2. Individual Superbubble passes took about 20% longer than Bubblesort. This is not surprising, in view of the larger number of swaps — the higher efficiency — made in each pass. Bubblesort spends a lot of its time comparing numbers, but then doing nothing about it; since only a few items are left to move to the front of the list, a step at a time.

3. The mean speed gain is defined in terms of "lists sorted per unit time". The range encountered overall was 17-69%. I think one should discount the rare extremes, as there will always be unusually ordered lists which make heavy demands on one or the other of the routines ✱ ✱).

However, the overall results speak for themselves: an improvement of 37% for the shorter lists, increasing to 43% for lists with 200 items. This trend probably continues, making Superbubble ever more superior to Bubblesort for longer lists.

Listing 1. Bubblesort

```
10   DIM A(100)
20   FOR k = 1 TO 100
30   READ A(k)
40   NEXT k
50   LET f = 1
60   FOR k = 1 TO 99
70   IF A(k)>A(k + 1) THEN LET f = 0:LET b = A(k): LET
     A(k) = A(k + 1): LET A(k + 1) = b
80   NEXT k
200  IF f = 0 THEN GO TO 50
```

Listing 2. Superbubble extra lines

```
130  FOR k = 99 TO 1 STEP - 1
140  IF A(k)>A(k + 1) THEN LET f = 0: LET b = A(k): LET
     A(k) = A(k + 1): LET A(k + 1) = b
150  NEXT k
```

Table 3

No. of items	Mean speed gain (of Superbubble*)	Range of gains
50	37%	24%-69%
100	40%	17%-50%
200	43%	33%-52%

Conclusions

Superbubble only requires a minor modification to the popular Bubblesort routine, but increases its speed by a large margin. If the latter is used extensively for its simplicity, there seems no reason why the former should not be used instead.

✱ ✱The 1-s.d. range for 50 items is 22-52%, and for 100 items — 31-49%.

First steps in Machine Code



Part 5. ROM Routines.

An introduction to Z80 Machine Code by David Nowotnik

Within the 8K of ROM fitted inside the ZX81, and the 16K in the Spectrum, there is a wealth of machine code subroutines. These, of course, supply the operating systems and BASIC translators for the computers, but there is no reason why these routines may not be used by machine language programmers. This is just one of the subjects to be covered in this, the penultimate part of our series on Z80 machine code. But before the ROM routines are examined, we'll complete the examination of bit operations started last time.

If you recall, last issue we examined the logical operators AND, OR and XOR. These allowed a bit-by-bit comparison of two bytes. Individual bits were also turned off, on, or were compared with SET, RESET and BIT. The other manipulation of bits allowed by machine code is the movement of bits within a byte. Essentially, bits can be moved left or right within a byte. At first glance, this might seem like a strange thing to do. But, if you realise that moving all the bits within a byte one place to the left effectively multiplies the value in the byte by two (and moving right divides by two), then these operations begin to make some sense (remember, the convention in representing a byte by eight bytes is to have the highest value bit on the left).

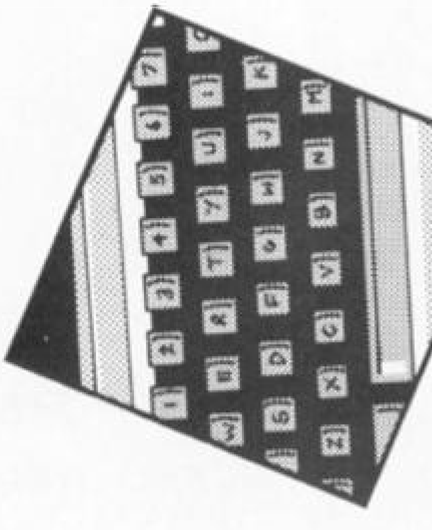
The shift and rotate instructions can be confusing to the beginner, and even a diagram of what they do cannot readily explain how they work. An animated display works much better, and that is just the purpose of the listing in Fig.1. It shows you how each of the shift and rotate instructions carry out their operations — in slow motion.

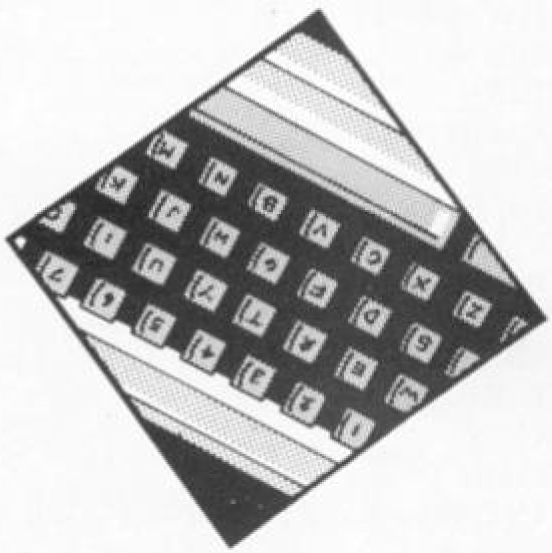
The program listing is designed for the ZX81; it will not work as written on the Spectrum; but to prevent Spectrum users feeling left out, Fig.2 contains pro-

Fig.1. Listing of the Shift/Rotate Demonstration progr

```
10 REM Z80 SHIFT/ROTATE DEMONSTRATION
15 REM D. NOWOTNIK.  ZX COMPUTING
20 REM JUNE 1985
25 DIM A$(9,8)
30 LET A$(1)="RLCA/RLC"
35 LET A$(2)="RLA/RL"
40 LET A$(3)="RRCA/RRC"
45 LET A$(4)="RRA/RR"
50 LET A$(5)="SLA"
55 LET A$(6)="SRL"
60 LET A$(7)="SRA"
65 LET A$(8)="RLD"
70 LET A$(9)="RRD"
75 LET B$="DEMONSTRATION OF SHIFT/ROTATE"
80 LET C$="        "
85 LET P=4000
100 CLS
105 PRINT AT 2,1;B$
110 PRINT AT 6,2;"SELECT:-"
115 PRINT
120 PRINT "    1.   ";A$(1)
125 PRINT "    2.   ";A$(2)
130 PRINT "    3.   ";A$(3)
135 PRINT "    4.   ";A$(4)
140 PRINT "    5.   ";A$(5)
145 PRINT "    6.   ";A$(6)
150 PRINT "    7.   ";A$(7)
155 PRINT "    8.   ";A$(8)
160 PRINT "    9    ";A$(9)
170 IF INKEY$="" THEN GOTO 170
175 LET C$= INKEY$
180 IF C$<"1" OR C$>"9" THEN GOTO 170
185 GOSUB (VAL C$*200)
190 GOTO 100
200 GOSUB 2000
210 GOSUB 4300
220 GOSUB 4400
230 GOSUB 6000
240 RETURN
400 GOSUB 2000
410 GOSUB 4300
420 GOSUB 4500
430 GOSUB 5000
```

```
440 GOSUB 6000
450 RETURN
600 GOSUB 2000
610 GOSUB 4600
620 GOSUB 4700
630 GOSUB 5000
640 GOSUB 6000
650 RETURN
800 GOSUB 2000
810 GOSUB 4600
820 GOSUB 4750
830 GOSUB 5000
840 GOSUB 6000
850 RETURN
1000 GOSUB 2000
1010 GOSUB 4300
1020 GOSUB 4800
1030 GOSUB 5000
1040 GOSUB 6000
1050 RETURN
1200 GOSUB 2000
1210 GOSUB 4600
1220 GOSUB 4850
1230 GOSUB 5000
1240 GOSUB 6000
1250 RETURN
1400 GOSUB 2000
1410 GOSUB 4900
1420 GOSUB 4600
1430 GOSUB 4930
1440 GOSUB 5000
1450 GOSUB 6000
1460 RETURN
1600 GOSUB 6100
1610 GOSUB 6400
1620 GOSUB 7000
1630 GOSUB 6000
1640 RETURN
1800 GOSUB 6100
1820 GOSUB 6500
1830 GOSUB 7000
1840 GOSUB 6000
1850 RETURN
2000 CLS
2010 PRINT AT 1,1;B$
2020 PRINT AT 4,2;A$(C)
2030 PRINT AT 7,12;"REGISTER"
2040 PRINT AT 8,11;"|---------|"
2050 PRINT AT 9,11;"|         |"
2060 PRINT AT 10,11;"|---------|"
2070 PRINT AT 11,12;"76543210"
2080 PRINT AT 13,16;"C"
2090 PRINT TAB 15;"|-|"
2100 PRINT TAB 15;"| |"
2110 PRINT TAB 15;"|-|"
2120 PRINT
2130 PRINT "REGISTER = A,B,C,D,E,H,L,(HL)"
```







gram lines to substitute in the Fig. 1 listing so that this program will work on the Spectrum.

Just to explain the basic operations, shift moves all the bits in a byte along one place in either direction. The last bit can either be 1 or 0 depending on the operation.

Rotate is a special form of the shift instruction. After all the bits have been moved left or right, the vacant bit is filled either with the value in the carry bit, or the bit which was moved out of the opposite end of the byte.

Confused? The Shift/Rotate program should explain it. After typing in the program lines, SAVE the program on tape and RUN it. You'll be presented with a menu listing each of the shift/rotate instructions. Press the number beside your choice. The instructions on screen should be clear, but essentially you'll be asked to fill byte(s) with values (between 0 and 255) and fill the carry flag with a 1 or 0. The byte value will be translated to binary, and will appear in a 'box' which represents the register or byte in RAM. The operation will then be demonstrated in slow motion, and the final values of byte(s) shown on the screen. As the original value(s) will also be on the screen, you should be able to see the effect of the operation on the byte value(s). Try each operation several times, using different input values, and you'll be surprised how soon the operations will become clear to you.

You may recall in part three of the series there was a machine code routine which used one of the rotate instructions (RL E); it was used to transfer, bit by bit, the contents of the E register (into which the flag register had been copied) into the carry flag. It demonstrated how you could test the bit contents on a register, one bit at a time, without using multiple BIT commands. If the program listing in part three was a mystery to you at the time, go back to it, and, with the shift/rotate demonstration program, see how it works.

Fig.3 contains the Z80 opcodes for all the shift and rotate instructions. That covers all the bit operations on the Z80's basic register array. Now, let's go on to the ROM routines.

The ROM

The ROM on both machines is a highly complex system of ▶

machine code subroutines. These can be used with the CALL instruction, (described earlier in the series), from within your own machine code routines. The problem for machine code programmers is knowing where the routines are located, what they do, and how they work (i.e. what data is required in registers, and what registers will be corrupted — will have their values changed — when a particular routine is CALLed).

Fortunately, for programmers, a certain Dr. Ian Logan spent many many hours carefully disassembling the ROM on both the ZX81 and Spectrum, then published the results of all his efforts. Both publications contain the assembly language listing of the ROM starting at address 0 and working steadily through to the end. Each subroutine is sectioned off, with a brief description of what that routine will do. Both books are published by Melbourne House press; the ZX81 book is called 'Sinclair ZX81 ROM Disassembly' and comes in two parts, while the Spectrum book has Dr. Frank O'Hara as co-author, and is called 'The Complete Spectrum ROM Disassembly'.

To give you some idea of the location of just a few of the ROM routines, there is a listing in Fig.4. To use any of them from your own routine, use CALL *address*, where *'address'* is the routine's start address (given in Fig.4).

There are a special set of subroutines at the beginning of ROM (on both machines) which have a different instruction for their implementation. These are the RST calls, the 'RESTARTS'. There are eight RST opcodes, and, as you can see from Fig.5, there is a single byte opcode for each of them — compare that with the CALL instruction which requires three bytes for its implementation. In machine code terms, that represents a big saving in time to carry out that instruction, and RST calls are intended for those operations which the designer of the ROM expected the system to use often. The purpose of the RST instructions in both the ZX81 and Spectrum are shown in Fig.5. Despite the many differences between the machines the basic operation of all eight RST routines is the same. There will be some examples, and hints, on using RST commands later, in the machine code examples section.

```
2140 GOSUB P
2150 PRINT AT 8,0;"ENTER"
2160 PRINT "REGISTER"
2170 INPUT D
2180 IF D<0 OR D>255 OR D<> INT D THEN GOTO 2170
2190 GOSUB 4100
2200 PRINT AT 9,12;Y$
2210 PRINT AT 8,0;C$
2220 PRINT C$
2230 PRINT AT 9,2;DD
2240 PRINT AT 15,0;"ENTER CARRY"
2250 INPUT E
2260 IF NOT (E=0 OR E=1) THEN GOTO 2250
2270 PRINT AT 15,0;C$;C$( TO 5); TAB 16;E
2280 PRINT AT 15,2;E
2290 GOSUB P
2300 RETURN
4000 FOR I=1 TO 25
4010 NEXT I
4020 RETURN
4100 LET Y$="00000000"
4110 LET DD=D
4120 FOR I=8 TO 1 STEP -1
4130 IF D/2<> INT (D/2) THEN LET Y$(I)="1"
4140 LET D= INT (D/2)
4150 NEXT I
4160 RETURN
4300 PRINT AT 9,12; CHR$ (CODE Y$+128)
4310 GOSUB P
4320 PRINT AT 9,12;" "; AT 9,6;CHR$ (CODE Y$+128)
4330 GOSUB P
4335 FOR I=1 TO 8
4340 PRINT AT 9,10+I;Y$(I)+" "
4345 FOR J=1 TO 10
4350 NEXT J
4355 NEXT I
4360 GOSUB P
4365 RETURN
4400 PRINT AT 9,6;" "; AT 9,19;CHR$ (CODE Y$+128);
AT 15,16;CHR$ (CODE Y$+128)
4405 GOSUB P
4410 PRINT AT 9,19;Y$(1); AT 15,16;Y$(1)
4415 LET Y$=Y$(2 TO )+Y$(1)
4420 GOSUB 5000
4425 RETURN
4500 PRINT AT 15,16; CHR$ (E+156)
4505 GOSUB P
4510 PRINT AT 15,16;" "; AT 9,19; CHR$ (E+156)
4515 GOSUB P
4520 PRINT AT 9,6;" "; AT 15,16; CHR$ (CODE Y$(1)+128)
4525 GOSUB P
4530 PRINT AT 15,16;Y$(1); AT 9,19; CHR$ (E+156)
4540 LET Y$=Y$ (2 TO )+CHR$ (E+28)
4550 RETURN
4600 PRINT AT 9,19; CHR$ (CODE Y$(8)+128)
4605 GOSUB P
4610 PRINT AT 9,19;" "; AT 9,24;CHR$ (CODE Y$(8)
```

```
+128)
4615 GOSUB P
4620 FOR I=7 TO 1 STEP -1
4625 PRINT AT 9,11+I;" "+Y$(I)
4630 FOR J=1 TO 10
4635 NEXT J
4640 NEXT I
4645 GOSUB P
4650 RETURN
4700 PRINT AT 9,24;" "; AT 9,12; CHR$ (Y$(8)+128);
AT 15,16;CHR$ (CODE Y$(8)+128)
4705 GOSUB P
4710 PRINT AT 9,12;Y$(8);AT 15,16;Y$(8)
4715 LET Y$=Y$(8)+Y$( TO 7)
4720 RETURN
4750 PRINT AT 15,16;CHR$ (E+156)
4755 GOSUB P
4760 PRINT AT 15,16;" "; AT 9,12; CHR$ (E+156)
4765 GOSUB P
4770 PRINT AT 9,24;" "; AT 15,16;CHR$ (CODE Y$(8)+
128)
4775 GOSUB P
4780 PRINT AT 9,12;CHR$ (E+28); AT 15,16;Y$(8)
4785 LET Y$=CHR$ (E+28)+Y$( TO 7)
4790 RETURN
4800 PRINT AT 9,6;" "; AT 15,16;CHR$ (CODE Y$+128)
4810 GOSUB P
4815 PRINT AT 9,23; CHR$ 156
4820 GOSUB P
4825 PRINT AT 9,23;" ";AT 9,19; CHR$ 156
4830 GOSUB P
4835 PRINT AT 9,19;"O"; AT 15,16;Y$(1)
4840 LET Y$=Y$(2 TO )+"O"
4845 RETURN
4850 PRINT AT 9,24;" "; AT 15,16;CHR$ (CODE Y$(8)+128)
4855 GOSUB P
4860 PRINT AT 9,6;CHR$ 156
4865 GOSUB P
4870 PRINT AT 9,6;" ";AT 9,12;CHR$ 156
4875 GOSUB P
4880 PRINT AT 9,12;"O";AT 15,16;Y$(8)
4885 LET Y$="O"+Y$( TO 7)
4890 RETURN
4990 PRINT AT 9,12;CHR$ (CODE Y$+128)
4905 GOSUB P
4907 PRINT AT 9,6;CHR$ (CODE Y$+128)
4910 GOSUB P
4915 PRINT AT 9,12;Y$
4920 GOSUB P
4925 RETURN
4930 PRINT AT 9,24;" "; AT 15,16;CHR$ (CODE Y$(8)+128)
4935 GOSUB P
4940 PRINT AT 9,6;" "; AT 9,12;CHR$ (CODE Y$+128)
4945 GOSUB P
4950 PRINT AT 9,12;Y$(1);AT 15,16;Y$(8)
4955 LET Y$=Y$(1)+Y$( TO 7)
4960 RETURN
```

More Registers . . .

As a final bit of theory for this issue, how about the revelation that the Z80 doesn't have one set of registers called 'A','B', 'C','D','E','H', and 'L' — but two. The reason for two sets is that the 'spare' set provide you with a little extra storage space within the CPU. If you remember that operations involving transfer of bytes from memory to the Z80 are relatively much slower than transfers within the CPU, then much time could be saved by using an alternative register set rather than accessing memory for temporary storage. There is a 'switching' system between the two sets of registers, and only one set can be used at any one time. For example, LD A,6 will only load the value '6' into the 'A' register currently in use, while the other 'A' register lies dormant until it is switched on, disabling the first 'A' register. When a register is switched 'off', it holds its value until it is switched back on again, and operations are carried out on that register.

There are two 'switching' instructions for the range of registers we have dealt with so far (believe it or not, there are more registers, and they will appear in the concluding part of the series). The BC, DE, and HL register pairs are 'switched' with the EXX instruction (opcode D9 hex). The AF pair are switched with the 'spare' AF pair using EX AF,AF (opcode 08 hex).

It is also possible to exchange the *values* of certain registers by a single exchange instruction. For example, the value held in DE can be transferred to HL, and vice versa with a single instruction EX DE,HL (opcode EB hex). A more complex exchange instruction involves the top of stack and the HL register pair. These two values can be exchanged with EX (SP),HL (opcode E3 hex). This takes the value held at the top of the stack, places it in HL, and places the previous value in HL onto the top of the stack. You can do some devious things with this instruction, such as changing the return address of a subroutine.

Now, to the machine code examples for this part of the series. Unlike some earlier examples, the routines that we will now look at for the two machines are so similar that they will be covered at the same time.

The first example is shown in Fig.6. This is a machine code ▶

routine to PEEK a byte value, and print that value in hexadecimal on the screen. It uses both a shift instruction, and an RST command, and so covers a lot of the theory described in this article.

The diagram in Fig.6 explains how a byte can be split into two parts. These half bytes are called — believe it or not — a nibble! One nibble can have a value between 0 and 15, which is exactly the range of a single unit of hexadecimal (00 to 0F), so the upper four bits (nibble) of a byte form the higher digit of a hexadecimal number, and the lower nibble the lower digit. So, to convert the byte value to hex, the value of each nibble has to be determined, then converted to the corresponding character to be printed on the screen. The value of the upper nibble is printed first, followed by the lower nibble.

With that description in mind, take a look at the assembly language listing of the machine code example in Fig.6. Ignore the first two lines for a moment; the address of the byte to be examined is loaded into HL, then the value of that byte is placed in the 'A' register, and copied into 'E'. The four lower bits are set to 0 with the AND 240 command, then the higher bits are shifted four times to the right (SRL) so that they now appear in the lower nibble of 'A'; the higher nibble of 'A' is filled with zeros, so 'A' contains the value of the higher nibble. The print subroutine is then called; this is slightly different for each machine as the character codes differ between the ZX81 and Spectrum.

In the case of the ZX81, the character zero ('0') has a character code value of 28; so adding 28 to the value in 'A' gives the appropriate character code. Fortunately, the character 'A' follows '9' in the ZX81's character set, so making life easier in converting decimal to hex.

This is not the case with the Spectrum. The code for '0' is 48, so, adding 48 to the value of the upper nibble in register 'A' gives the character code IF the value is between 0 and 9. For a larger value, a further seven has to be added, as the character code for the letter 'A' is seven above the character after '9' (you can check this in the back of your Spectrum handbook). This is why there is a CP (compare) instruction in the Spectrum print routine; if the value is greater than 57 (character code of '9') then another 7 is added to

```
5000 LET X=0
5005 FOR I=8 TO 1 STEP -1
5010 LET X=X+(CODE Y$(I)-28)*(2**(8-I))
5020 NEXT I
5030 PRINT AT 9,22;"= ";X
5040 RETURN
6000 PRINT AT 21,2;"PRESS ANY KEY TO CONTINUE"
6010 IF INKEY$="" THEN GOTO 6010
6020 RETURN
6100 PRINT AT 2,1;B$
6105 PRINT AT 4,2;A$(C)
6110 PRINT AT 7,14;"(HL)"
6115 PRINT AT 8,11;"|-+------|"
6120 PRINT AT 9,11;"|        |"
6125 PRINT AT 10,11;"|--------|"
6130 PRINT AT 11,12;"76543210"
6135 PRINT AT 13,16;"A"
6140 PRINT AT 14,11;"|--------|"
6145 PRINT AT 15,11;"|        |"
6150 PRINT AT 16,11;"|--------|"
6155 PRINT AT 17,12;"76543210"
6160 GOSUB P
6165 PRINT AT 9,0;"INPUT (HL)"
6170 INPUT D
6175 IF D<0 OR D>255 OF D<>INT D THEN GOTO 6170
6185 GOSUB 4100
6190 PRINT AT 9,0;C$+"   ";AT 9,2;DD
6195 PRINT AT 9,5;Y$
6200 LET Z$=Y$
6205 PRINT AT 15,0;"INPUT A"
6210 INPUT D
6215 IF D<1 OR D>255 OR D<>INT D THEN GOTO 6210
6220 GOSUB 4100
6225 PRINT AT 15,0;C$;AT 15,12;Y$;AT 15,2;DD
6235 LET X=128
6330 LET R$=CHR$ (CODE Z$+X)+CHR$ (CODE Z$(2)+X)+
CHR$ (CODE Z$(3)+X)+CHR$ (CODE Z$(4)+X)
6335 LET S$=CHR$ (CODE Z$(5)+X)+CHR$ (CODE Z$(6)+
X)+CHR$ (CODE Z$(7)+X)+CHR$ (CODE Z$(8)+X)
6340 LET T$=CHR$ (CODE Y$(5)+X)+ CHR$ (CODE Y$(6)+
X)+CHR$ (CODE Y$(7)+X)+CHR$ (CODE Y$(8)+X)
6345 RETURN
6400 PRINT AT 15,16;T$
6405 GOSUB P
6410 PRINT AT 15,16;"    ";AT 15,23;T$
6415 GOSUB P
6420 PRINT AT 9,12;R$
6425 GOSUB P
6430 PRINT AT 9,12;"    ";AT 15,16;R$
6435 GOSUB P
6440 PRINT AT 9,16;"    ";AT 9,12;Z$(5 TO )
6445 GOSUB P
6450 PRINT AT 15,23;C$;AT 9,16;T$
6455 LET T$=Z$(5 TO )
6460 LET R$=Y$(5 TO )
6465 LET Y$=Y$( TO 4)+Z$( TO 4)
6470 LET Z$=T$+R$
```



```
6472 GOSUB P
6475 PRINT AT 9,12;Z$;AT 15,12;Y$
6480 RETURN
6500 PRINT AT 15,16;T$
6505 GOSUB P
6510 PRINT AT 15,16;"       ";AT 15,23;T$
6515 GOSUB P
6520 PRINT AT 9,16;S$
6525 GOSUB P
6530 PRINT AT 9,16;"       ";AT 15,16;S$
6535 GOSUB P
6540 PRINT AT 9,12;"       ";Z$( TO 4)
6545 GOSUB P
6550 PRINT AT 15,23;C$;AT 9,12;T$
6555 LET T$=Z$(5 TO )
6560 LET R$=Y$(5 TO )
6565 LET Y$=Y$( TO 4)+T$
6570 LET Z$=R$+Z$( TO 4)
6572 GOSUB P
6575 PRINT AT 9,12;Z$;AT 15,12;Y$
6580 RETURN
7000 LET X=0
7005 FOR I=8 TO 1 STEP -1
7010 LET X=X+(CODE Z$(I)-28)*(2**(8-I))
7020 NEXT I
7030 PRINT AT 9,23;"= ";X
7040 LET X=0
7045 FOR I=8 TO 1 STEP -1
7047 LET X=X+(CODE Y$(I)-28)*(2**(8-I))
7050 NEXT I
7055 PRINT AT 15,23;"= ";X
7060 RETURN
```

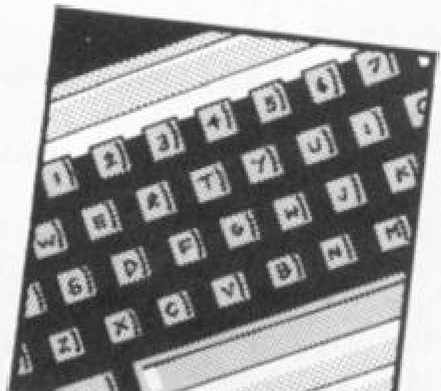


Fig.2. Exchange program lines for the Spectrum version of Shift/rotate.

```
4000 FOR I=1 TO 100
4300 PRINT AT 9,12; INK 7; PAPER 0;Y$(1)
4320 PRINT AT 9,12;" ";AT 9,6; INK 7; PAPER 0;Y$(1)
4345 FOR J=1 TO 40
4400 PRINT AT 9,6;" ";AT 9,19; INK 7; PAPER 0;Y$(1);
AT 15,16;Y$(1)
4500 PRINT AT 15,16; INK 7; PAPER 0;E
4510 PRINT AT 15,16;" ";AT 9,19; INK 7; PAPER 0;E
4520 PRINT AT 9,6;" ";AT 15,16; INK 7; PAPER 0;Y$(1)
4530 PRINT AT 15,16;Y$(1);AT 9,19; INK 7; PAPER 0;E
4540 LET Y$=Y$(2 TO )+ STR$ E
4600 PRINT AT 9,19; INK 7; PAPER 0;Y$(8)
4610 PRINT AT 9,19;" ";AT 9,24; INK 7; PAPER 0;Y$(8)
4630 FOR J=1 TO 40
4700 PRINT AT 9,24;" ";AT 9,12; INK 7; PAPER 0;Y$(8);
AT 15,16;Y$(8)
4750 PRINT AT 15,16; INK 7; PAPER 0;E
4760 PRINT AT 15,16;" ";AT 9,12; INK 7; PAPER 0;E
4770 PRINT AT 9,24;" ";AT 15,16; INK 7; PAPER 0;Y$(8)
4780 PRINT AT 9,12;E;AT 15,16;Y$(8)
4785 LET Y$=STR$ E+Y$( TO 7)
4800 PRINT AT 9,6;" ";AT 15,16; INK 7; PAPER 0;Y$(1)
```

the 'A' register to ensure thatthe correct alphabetic character is printed.

Once the routine has worked out the right character code, use is made of RST 10 (hex) to print the character on the screen at the next print position. On return from this subroutine, the original value of the byte is returned to the 'A' register from the storage place in 'E', and the higher nibble masked (set to zero) with the command AND 15. The print routine is called again to place this value on the screen.

So, type in the appropriate hexloader from Fig.6 (remember to lower RAMTOP on your 16K ZX81 first), then SAVE and RUN. In response to the flashing cursor, enter a value between 0 and 255 (integers only) and you should see the hexadecimal equivalent printed on the screen. The RST 10 instruction on the ZX81 will only print to the screen, but with the Spectrum, you have a little more flexibility. RST 10 can be used to send characters to the printer or the lower part of the screen (the area normally reserved by the system) as well as the 'upper' screen, which we have access to through BASIC. The way the Spectrum decides to which 'device' it should be printing is by setting some system variables; the safest way of doing this is to use one of the ROM routines, and this is located at 1601 (hex); this is the routine called at the start of the Spectrum machine code routine. The value in the 'A' register when this routine is called defines which device is activated. A value of 2 activates the main screen; 3 activates the printer, and 1, the lower screen.

You can also send non-printable characters via the RST routine, although care has to be taken when doing this. For example, INK and PAPER commands can be sent via RST 10, as well as AT and TAB. The best way of learning about the flexibility of RST 10 is to try out various things for yourself.

The other machine code example is shown in Fig.7. This is a simple routine which shows you how RST 08 — the error message routine — works. You'll notice that there is no RET instruction, this is because a return to BASIC occurs automatically during the operation of RST 08. The routine allows you to put values into the byte immediately following the RST 08 command. This byte holds the error number (plus one). Try putting various values into this ▶

```
4815 PRINT AT 9,23; INK 7; PAPER 0;"O"
4825 PRINT AT 9,23;" ";AT 9,19; INK 7; PAPER 0;"O"
4850 PRINT AT 9,24;" ";AT 15,16; INK 7; PAPER 0;Y$(8)
4860 PRINT AT 9,6; INK 7; PAPER 0;"O"
4870 PRINT AT 9,6;" ";AT 9,12; INK 7; PAPER 0;"O"
4890 PRINT AT 9,12; INK 7; PAPER 0;Y$(1)
4907 PRINT AT 9,6; INK 7; PAPER 0;Y$(1)
4930 PRINT AT 9,24;" ";AT 9,12; INK 7; PAPER 0;Y$(8)
4940 PRINT AT 9,6;" ";AT 9,12; INK 7; PAPER 0;Y$(1)
5010 LET X=X+(CODE Y$(I)-48)*(2^(8-I))
6330 LET R$=Z$( TO 4)
6335 LET S$=Z$(5 TO )
6340 LET T$=Y$(5 TO )
6400 PRINT AT 15,16; INK 7; PAPER 0;T$
6410 PRINT AT 15,16;"    ";AT 15,23; INK 7; PAPER 0;T$
6420 PRINT AT 9,12; INK 7; PAPER 0;R$
6430 PRINT AT 9,12;"    ";AT 15,16; INK 7; PAPER 0;R$
6440 PRINT AT 9,16;"    ";AT 9,12; INK 7; PAPER 0;S$
6450 PRINT AT 15,23;C$;AT 19,16; INK 7; PAPER 0;T$
6510 PRINT AT 15,16;"    ";at 15,23; INK 7; PAPER 0;T$
6520 PRINT AT 9,16; INK 7; PAPER 0;S$
6530 PRINT AT 9,16;"    ";AT 15,16; INK 7; PAPER 0;S$
6550 PRINT AT 15,23;C$;AT 9,12; INK 7; PAPER 0;T$
7010 LET X=X+(CODE Z$(I)-48)*(2^(8-I))
7047 LET X=X+(CODE Y$(I)-48)*(2^(8-I))
```

Fig.3. Opcodes for the Shift and Rotate instructions

```
RLCA    07        RLA    17        RRCA    0F         RRA    1F
RLC A   CB07      RL A   CB17      RRC A   CB0F       RR A   CB1F
RLC B   CB00      RL B   CB10      RRC B   CB08       RR B   CB18
RLC C   CB01      RL C   CB11      RRC C   CB09       RR C   CB19
RLC D   CB02      RL D   CB12      RRC D   CB0A       RR D   CB1A
RLC E   CB03      RL E   CB13      RRC E   CB0B       RR D   CB1B
RLC H   CB04      RL H   CB14      RRC H   CB0C       RR H   CB1C
RLC L   CB05      RL L   CB15      RRC L   CB0D       RR L   CB1D
RLC(HL) CB06      RL(HL) CB16      RRC(HL) CB0E       RL(HL) CB1E

SLA A    CB27        SRA A    CB2F        SRL A    CB3F
SLA B    CB20        SRA B    CB28        SRL B    CB38
SLA C    CB21        SRA C    CB29        SRL C    CB39
SLA D    CB22        SRA D    CB2A        SRL D    CB3A
SLA E    CB23        SRA E    CB2B        SRL E    CB3B
SLA H    CB24        SRA H    CB2C        SRL H    CB3C
SLA L    CB25        SRA L    CB2D        SRL L    CB3D
SLA(HL)  CB26        SRA(HL)  CB2E        SRL(HL)  CB3E

          RLD   ED6F              RRD   ED67
```

(All opcodes are in hexadecimal)

Fig.4. Some Useful ROM Routines:

1. ZX81

02BB - Keyboard scanning routine; this returns a coded version of the key in HL. To translate this to a

character code, you'll need to transfer HL contents to BC and call the routine at 07BD

02E7 – Set FAST mode
0A2A – CLS routine
0C0E – SCROLL routine
0F2B – Set SLOW mode

2. Spectrum

028E – Keyboard scanning routine
03B5 – BEEP subroutine
0DFE – SCROLL subroutine (number of lines in B)
0E44 – Clears the lower part of the screen, the number of lines governed by the value in 'B'.
0D6E – Clears the 'command' area of the screen

Fig.5. RST commands

RST 00 (opcode C7) – When you first switch on your computer, this is where it starts. The routine carries out some tests, then wipes RAM clean. You can use RST 00 to make sure the computer has completely reset.

RST 08 (opcode CF) – The error trapping routine – it causes the error messages to be generated, and stops BASIC. The error number is the value in 'A' minus 1 when the restart routine is called.

RST 10 (opcode D7) – The print routine – it prints on the screen (or 'active' device in the Spectrum) a character, or print control character.

RST 18 (opcode DF) – Collects a character addressed by the system variable CH-ADD, and checks whether it is printable.

RST 20 (opcode E8) – Used in the BASIC translator to check collect the next character, and translate it.

RST 28 (opcode EF) – Calls the floating point calculator routine.

RST 30 (opcode F8) – Creates a space in RAM in the workspace; the size of the space is governed by the value in BC.

RST 38 (opcode FF) – The 'Maskable Interupt' routine – some details on that in the next part of the series.

byte, and if an error exists for that number (plus one), then you'll see that message at the bottom of the screen.

Next issue we'll reach the final part of this series. There will be two long machine code examples covering many of the operations covered in this series, some notes on items not covered, and some suggestions for further reading.

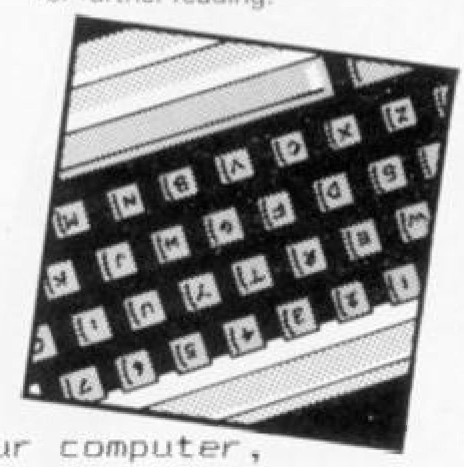
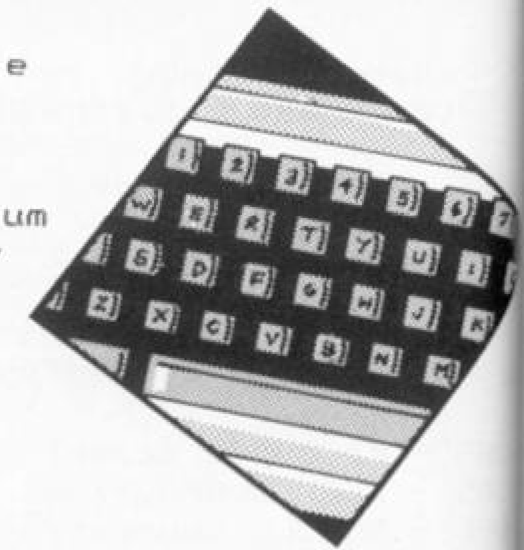
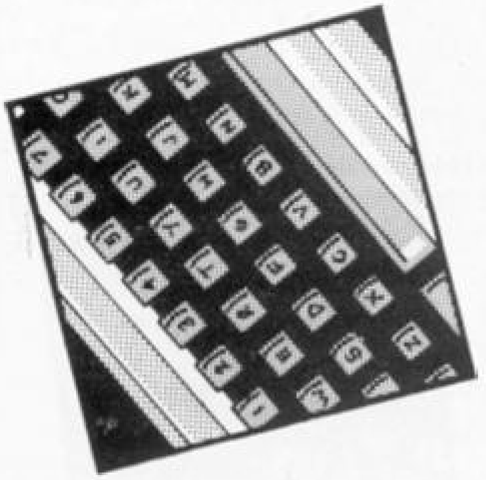


Fig.6. Print hexadecimal example



Assembly language listing

```
LD   A,2          3E02    )  Spectrum
CALL 5633         CD0116  )    only
LD   HL,32000     21007D
LD   E,A          5F
AND  240          E6F0
SRL  A            CB3F
SRL  A            CB3F
SRL  A            CB3F
SRL  A            CB3F
CALL PRINT        CD4E75
LD   A,E          7B
AND  15           E60F
CALL PRINT        CD4E75
RET               C9
```



ZX81 PRINT Subroutine

```
ADD  A,28         C611C
RST  18           D7
RET               C9
```

Spectrum PRINT Routine

```
ADD  A,48         C630
CP   58           FE38
JR   C,+2         3802
ADD  A,7          C607
RST  18           D7
RET               C9
```



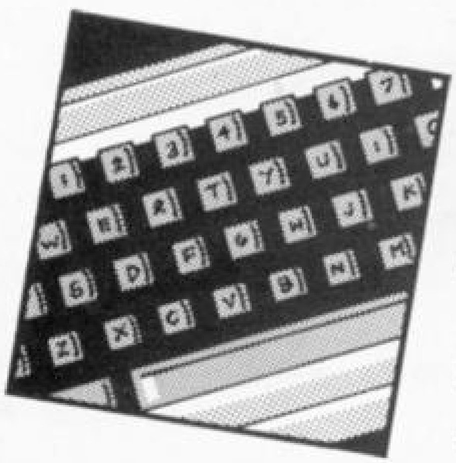
ZX81 PROGRAM Listing

First, lower RAMTOP with these three direct commands

```
POKE 16388,47
POKE 16389,117
NEW
```

Then type in, SAVE, and RUN, the following listing:

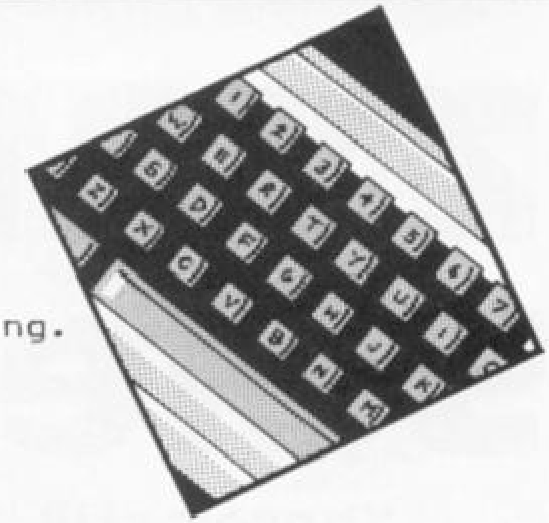
```
10 LET X=30005
20 INPUT Y
30 PRINT AT 21,0;X,Y
40 SCROLL
50 IF Y=-1 THEN STOP
60 POKE X,Y
70 LET X=X+1
80 GOTO 20
```



Enter the following sequence of numbers:

33,0,125,126,95,230,240,203,63,203,63,203,63,203,63,
205,78,117,123,230,15,205,78,117,201,198,28,215,201,-1

NEW the machine code loader, then type in, and RUN

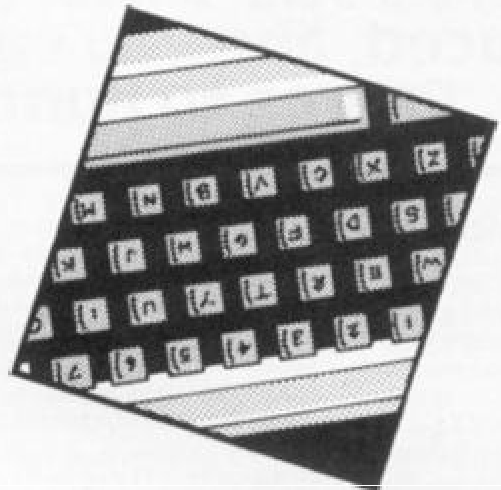


```
10 INPUT X
20 POKE 32000,X
30 RAND USR 30005
40 PRINT
50 GOTO 10
```

Your decimal to hex conversion should now be working.

Spectrum PROGRAM listing

Type in, SAVE, and RUN this program:



```
10 CLEAR 29999
20 LET x=30000
30 READ y: IF y=-1 THEN GOTO 50
40 POKE x,y: LET x=x+1: GOTO 30
50 INPUT "Enter a number (0-255) ";z
60 POKE 32000,z
70 RANDOMIZE USR 30000
80 PRINT
90 GOTO 50
100 DATA 62,2,205,1,22,33,0,125,126,95
110 DATA 230,240,203,63,203,63,203,63
120 DATA 203,63,205,78,117,123,230,15
130 DATA 205,78,117,201,198,48,254,58
140 DATA 56,2,198,7,215,201,-1
```

Fig.7. BASIC Error message demonstration

In the ZX81, lower RAMTOP with the same three direct commands as listed in Fig.6. With the Spectrum, lower RAMTOP with the command:

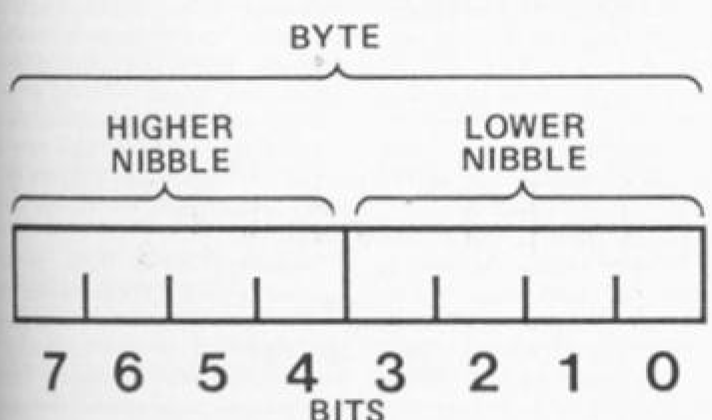
```
CLEAR 29999
```

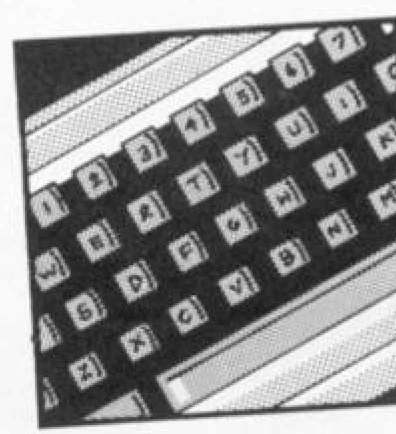
Now, type in, and RUN this listing:

```
10 POKE 30000,207
20 INPUT X
30 POKE 30001,X
40 RAND USR 30000         (ZX81)
40 RANDOMIZE USR 30000    (Spectrum)
```

RUN each time you get an error message; check the message against the number you have INPUT, and the section on error messages in your handbook.

Assembly language listing: RST 08 (that's all!)





ZX81 Soft Selection

There's still '81 software being produced, and you can rely on Nick Pearce to hunt it out.

Stefan Schmidt

ZX Hi-Res Toolkit is an impressive utility from a West German ZX81 programmer. As the title implies, it makes a high resolution graphics display available on the 16K ZX81 giving the user access to a 256 by 192 pixel display.

The program is written entirely in machine code and contains 16 Hi-Res commands. These are fully integrated into BASIC making the program extremely easy to use; for example PRINT USER PLOT, 100, 150 will set the pixel with the coordinates 100, 150.

Other commands include UNPLOT, DRAW and UNDRAW (the end coordinates of the line to be drawn are specified), INVERT (to invert the video image), SCROLLUP and SCROLLDOWN, TEXT (which writes the contents of a character string to a specified position on the screen), and SCRSAVE and COPY (to save or copy the current Hi-res screen contents to cassette or printer)."

The program does have limitations. For example there is no CIRCLE command, although one can be programmed in BASIC. The circle drawing program on page 125 of the Spectrum manual works with PLOT replaced with PRINT USR PLOT, but is slow taking about three minutes to complete. Similarly there are no user-defined characters (BIN on the Spectrum) although again these could be programmed in BASIC but would run slowly.

There was one small bug in my review copy, the command PRINT USER MEMO which is supposed to show how many bytes are free did not work, but everything else worked perfectly.

The display can be switched between Hi-Res and normal resolution at will. Even in Hi-Res mode all error messages and the cursor are displayed in the normal position at the bottom of the screen. The toolkit has its own set of four error messages. There is a demonstration display which runs when the program has been loaded.

I was very impressed with this toolkit, in particular, the ease with which it can be used. This one will not leave the beginner thoroughly confused as, I'm afraid, do some other utilities of this sort. Mr Schmidt has also written a fast load program, Turbotape, which apparently allows programs to be transfered to and from cassette at 12 times normal speed. If it works as well as Hi-Res Toolkit it will be good indeed.

ZX Hi-Res Toolkit costs £6 from Stefan Schmidt, Lindenseestr. 9, 6090 Ruesselsheim 5, West Germany.

5D compendium Tape1 5DPrograms

5D Compendium contains twelve programs for the 16K ZX81 by five authors. The programs include games, arcade action, utilities, and an adventure. They are written in BASIC although some have been compiled using the PSS program, MCoder.

The first program is an introduction to the compendium. It contains credits and copyright information. Next is a short program which sets out the contents.

Wash-n-Slosh is the first of three arcade games and is quite good fun. You cannot pay your restaurant bill, and so find yourself in the kitchen washing dishes. There you rush up and down ladders, jump from platform to platform, and step on and off moving platforms (strange kitchen, eh?), in a frantic attempt to get plates from a lift into one of two sinks and then over to another part of the kitchen. Occasionally, a bomb comes down in a lift which you are supposed to grab and dispose of safely, but unless you happen to be very close to the lift this is an impossibility, the bomb explodes and you lose a life. You also lose a life if you misjudge a jump and miss a platform. You have three lives per game. The object is to build up a high score within the set time limit.

The second game, Assassin, is similar in many respects. As a guard you must protect your king and queen as they proceed in a horse drawn carriage along a crowd-lined street. Assassins appear at random in the crowd and must be removed to the police station before they strike. Bombs have to be dealt with, and there are bonus points for collecting what the horses drop for the royal roses (the horses are loose to say the least). There is a time limit, and, if the royal party complete their procession they begin again and the difficultyof the game increases. Assassin is an enjoyable game, but like Wash-n-Slosh there just is not the time to do everything so the game can be frustrating.

Weed Attack is the third arcade game, and is similar yet again. In this one you have to prevent you garden being overrun by giant weeds by racing around applying weedkiller.

All three games have onscreen instructions. Action is generally fast and responsive, and the ZX81 graphics have been used to good effect. They are very similar to each other, probably because they have the same author.

Haunted House comes next and is the only adventure included in the compendium. It is a reasonable game with plenty of variety and includes a few graphic displays (pictures of locations). It is quite short as adventures go, with about 10 objects and a similar number of locations. There are plenty of hazards to be dealt with (usually on a fight, flee or bribe basis) and even magic words to find. It is written in BASIC which imposes the usual limitations.

Stones is a game of strategy. It is the same game that was reviewed in the Dec/Jan 1984 edition of this magazine. It is the sort of game well suited to computer simulation and this version works reasonably well.

Next comes Odd One Out. The object is simply to spot the odd one out of four intricate patterns. A new pattern is created after each go, and the computer highlights the odd pattern.

In Picslide, a 4-by-4 grid is displayed on the screen in which patterns can be drawn by using the cursor keys. Each square in the grid is divided into 8-by-8 pixels. You can draw in black or white (which leaves spaces but doesn't delete existing black pixles), and the whole grid can be cleared. The two subsequent programs contain predrawn Picslide displays: of a train and a sailing boat. Apparently the grids can be shuffled so that an opponent can try to recreate your original picture, but there seemed to be no instructions on how this is done. Unfortunately the two utility programs in the compendium, Functions and Display Generator, were also without instructions.

Hangman comes next and is a version of the game in which you are given the definition of a word which you must guess before being "hung" by the computer. There seem to be about 100 words in all. The game works reasonably well and has effective graphics.

Horse Race is the penultimate program and is a game of chance. You choose from five runners, the only guide to form being the latest betting prices. The horses are displayed as they race across the screen to the finish. A number of players can bet and their winnings are recorded.

Finally, 21-or-Bust is of course a ZX81 implementation of the card game. You can play an opponent or the computer. The cards are displayed face down and, as you twist, they are

turned face upwards, this means that you can both see your hand and that of the ZX81. Graphics are reasonable, colours and suites which are unecessary in this game are not shown.

In general, 5D Compendium is a reasonable cassette and is good value for money, though better instructions are needed for some of the programs. None of the 12 programs is original or breaks new ground, however the cassette might well serve as a cheap introduction for the beginner.

5D Compendium Tape 1 costs £5.95 from 5D Programs, 12 Fleming Field, Shotton Colliery, County Durham DH6 2JF.

BRIDGEHEAD
G. Barker

Bridgehead is a computer wargame from Gavin Barker of 5D Programs. For the 16K ZX81, it is loaded in two parts; a short program giving instructions, followed by the game itself.

The objective of the game is to establish a bridgehead then conquer the island (shades of the Falklands?). You choose one of five scenarios, and have land, sea and air forces at your disposal.

To win the war you must take control of the capital, five major towns, the airport, and two ports. To start with, you can only move your landing craft; they become land divisions as you successfully get them to the island. Each force has a power rating which enemy attacks will weaken. Status reports can be called up frequently, and you occasionally receive telex messages and other surprise reports.

Bridgehead is a long game, and progress at times seems rather tedious, but it works well and the graphic display of the island adequately illustrates the progress of play. Not outstanding, and reasonable value for money.

Bridgehead costs £3.00 from G. Barker, 12 Fleming Field, Shotton Colliery, County Durham DH6 2JF.



GALACTIC TROOPER
Romik Software

Galactic Trooper is a fast moving arcade game. The landing craft of the galactic attack force are in formation in columns at the top of the screen. You move your craft along the bottom trying to destroy as much of the force as possible before the inevitable happens and you are obliterated. A mother ship services the galactic force; if you destroy it you gain 500 points. There are three skill levels, but whatever skill level you select the difficulty of the game increases as you play.

The action is good, and effective use is made of the ZX81 graphics for the display. Once you get the hang of the game it is possible to build up a high score. The computer keeps a record of the best score. A good game from Romik Software.

Romik Software Ltd is at 272 Argyle Avenue, Slough, Berks. The cassette retails at £2.99.

Tortoise Wise

More lines from a Parent who Gets Left Behind, by David Stewart.

I'm beginning to wonder if there's more to this race between the Tortoise and the Hares than a difference in the rate at which we run.

Regular readers of this spot will know by now that I am the Tortoise and my two young sons are the Hares. The race started when we bought a Spectrum and, amidst jeers from the Hares, this middle aged Tortoise declared that he too could learn to use it and understand it as well as they could. Of course, they have been ahead ever since. But that doesn't matter. I haven't even dreamt of giving up. Until last week that is.

It didn't come upon me suddenly. It's just that, well over the last month or so I've been noticing some strange abilities which the Hares seem to possess that I don't. I borrowed some games from a friend, but when I got home discovered that he had forgotten to include the instructions for two of them.

"Sorry," I told the hares. "I'll get them next time."

"Don't worry, we'll load them anyway."

"There's really no point," I reasoned. "you'd just get impatient and waste a lot of time." But they insisted, and I left them to prove my point, waiting for the growls of despair to echo around the house before I went in to say "Told you so."

After about an hour and not a sound from the room next door where the computer is kept, I crept back to see what was going on. They were both engrossed in playing one of the new games.

"But how . . . ?" I asked weakly.

"Easy," they muttered. "we just worked it out." And to prove their point they invited me to have a go, explaining what I had to do and announcing their scores so far.

And that's another thing. I don't seem to be able to handle a joystick and firing button like they can, and without it, using keys only, I have to confess to being almost useless.

Then there was the tape of programs I borrowed which only had the titles listed on a piece of paper. Consequently I was having problems locating individual programs at the end of the tape. One of the hares offered to help.

"You can tell where you are by listening Dad," he explained. And he could. His fingers worked the Play, Rewind and Forward buttons on the tape recorder with the same lightning dexterity he showed when using the Spectrum keyboard. He could find any program on that tape just by listening to the LOADing noise . . . . .

So, I went to see the Doctor.

"Check the hearing please Doc. I don't seem to be able to hear so well these days. And while you're at it check the old reflexes as well. And could you get me an appointment at the opticians too?" It should have been reassuring but it wasn't, to be told Health wise everything is A1. Tortoise wise I'm beginning to wonder.

Or perhaps the medical profession needs to get up to date. After all he only tested my reflexes by hitting parts of my anatomy with a little hammer. Perhaps he should have sat me down in front of a monitor screen and given me a joystick . . . . . . ?

Lightmagic — Graphics Designer

The Shape of things to come from New Generation Software? Colin Christmas puts you in the picture.



Over the last year or so, I have had the pleasure of being able to review most of the great Graphics Utilities which have been produced for the Spectrum. I say pleasure, because this is the field which really excites me. Games, I confess, I can usually take or leave. But a good Graphics program will keep me in front of the screen for hours.

I am by nature, a Doodler. So that even without a particular assignment I will play with shapes, lines and colours just for the fun of it. Any graphics utility which gives me that facility is for me immediately impressive, but I also believe that this facility is important from a user's point of view.

My next criterion is always the utilities potential. Just how far can you go beyond the important stage of Doodling? Can you develop ideas and designs? How easy it is to scrap one screen and start another with the same idea? And can you go on building from one idea w more line, shape, and colour?

This is not just a question value for money. New graphi programs have got to be able extend and develop our o creative abilities. They have take our micros to new and e citing places in visual terms, raise our horizons and our e pectations of the micro as creative tool.

Personally, I believe th such programs have to ha what can only be described he in very general terms as 'Educ tional Application'. As mo schools buy computers, a more parents want their childr to be familiar with them, so t software produced for the must have the same appeal a value that educators would e pect from a new textbook series for schools on Televisio

Such a philosophical i troduction has been qu deliberate. LIGHTMAGIC Nigel Hicken from New Gene tion Software has had me hoo ed from the first time I loaded into my 48K Spectrum.

Magic

The Cursor, a small circle on t screen, can be moved either using the Cursor keys, or Kempston or Sinclair Joysti Having made this selection, t Main Menu is displayed and becomes immediately obvio that this utility, like others of kind, offers two main option The first, called SCREE EDITOR is for the creation of a work. The second, called UD DESIGNER speaks for itself.

Screen Editor offers fi modes. Mode status displayed along with curs coordinates, and two othe operational states, in boxes u ing the bottom two lines of t screen. Within each mod various other facilities a available.

For example, in PEN mod you are given a fairly straightfo ward doodle pad facility. Apa from line drawing using the cu sor, being able to construct c cles around the cursor positio fill areas with current ink colou change ink colour, move ov any part of your artwork wi the cursor 'up' as it were or era ing any lines it travels over, yo can also speed up or slow dow cursor movement, check pos tioning of objects on the scree by superimposing a grid co responding to the character cel on the screen, enlarge th quarter of the screen in whic the cursor is positioned, p

single pixels on the screen and, using this as a reference point reposition the cursor accurately on the screen.

Three other facilities in Pen Mode deserve special mention.

BAND enables a line to be drawn from the point where this facility is selected, to the current cursor position. As the cursor is then moved, this line is stretched. Its suggested use for producing angled lines is very effective and time saving. It can also be used to Erase sweeps of the artwork rather like a windscreen wiper.

CLEAR can be used either to erase the entire screen, or a quarter screen if it is enlarged. But it can also be used to set the entire screen to ink and paper colour.

SAVE PICTURE IN MEMORY and RECALL PICTURE FROM MEMORY are especially useful options which, hopefully speak for themselves.

Plus!!

The most creative facilities this program offers, are yet to come. If you select BRUSH MODE, then as well as still being able to use most of the options offered in Pen Mode, you can draw using 'brush' strokes. The effect is sensational, and has to be seen to be believed. The width and pattern of stroke can be altered from an italic nib type effect to a spray dot effect, not unlike a slow motion air brush. Each effect can be startlingly enhanced by going over areas a number of times with the 'brush'. Density and shading can be controlled very effectively in this manner. And some very beautiful freehand work achieved if the straight and accurate lines of Pen Mode seem a little too mechanistic and cold for your style.

BLOCK MODE allows blocks of up to 64 character cells to be repositioned on the screen, or copied to another part of the screen. A square of 8 × 8 characters is available for rotating objects and also to mirror them.

TEXT MODE and UDG MODE allow text and a selection of UDG characters to be positioned on the screen. They are 'picked up' from the banks displayed and can be doubled in height, rotated, reversed or inverted before being displayed on the screen wherever you position them using the cursor.

LIGHTMAGIC also offers two other familiar options. The UDG DESIGNER and the COMP-SCREEN. Both are, by now, essential tools of the Graphics utility and are, in this instance, very easy to use. The first is self explanatory to graphics addicts and the second enables the user to compress and save data read into the Spectrum. COMP-SCREEN is on the cassette after LIGHTMAGIC and is loaded separately. The amount of memory saved will of course depend on the amount of information in the screen you wish to compress. Once compressed, the start addresses of the screens are listed with the start addresses of the reconstruction routine and the RAMTOP value that will have to be set. The screens are then saved to tape. To retrieve the screens for use in your own program, a CLEAR command is used to set RAMTOP, the screens LOADed and a RANDOMISE USER call is then necessary together with the DATA screen start call, to display each picture. All screens and UDGs can be saved and loaded to and from tape of course, whether compressed or not.

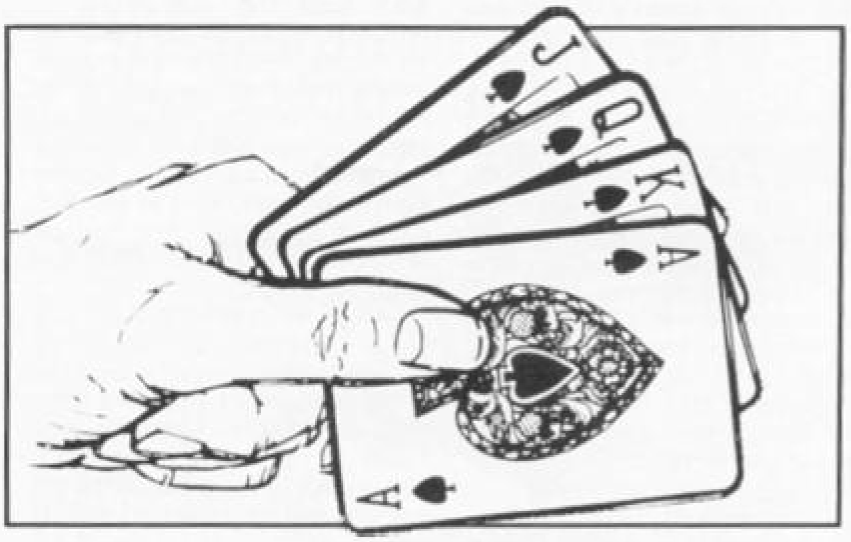
Not forgetting . . .

The manual accompanying LIGHTMAGIC gets full marks for clarity and ease of use. An example program for using UDGs in your own program is included along with comprehensive hints on Erasing, Enlarging and Reducing, with fully worked examples for using Pen and Brush Modes, although in fact I have not tried these yet. There are layouts for both the Spectrum 48K and the Spectrum + printed on the back cover so that you can produce your own overlays with all the commands for LIGHTMAGIC at your fingertips. If you did not wish to go this far, the commands for Screen Editor are Tabulated at the end of the manual for quick reference along with a clear and accurate index.

All in all, LIGHTMAGIC has an exceptionally well produced manual and a powerful and impressive piece of software from New Generation. One can only hope that this Utility will find a place with all the other software being used in Schools and at home.

Cribbage

Ian A Stewart presents his version of the Londoner's favourite, the classic card game — Cribbage.



Cribbage is perhaps the most interesting card game for 2 players, due to the blend of luck and skill involved. This program for the 48k ZX Spectrum plays a challenging game of 6 card cribbage, with the playing cards and cribbage board displayed in colour graphics on the screen.

Operation

The program is loaded in the normal way by typing LOAD "cribbage" or LOAD "". Loading from cassette will take approximately 2 minutes, after which the program will automatically start. If required, a demonstration of scoring on the crib board and operating instructions will be given by the program at appropriate times during play. The description of the rules is brief however, and newcomers to cribbage may prefer to read a comprehensive description in a book of card games.

The program always calculates the score for both hands (making cheating impossible), but if the "muggin's rule" option is selected, the player must enter his own score, which will be checked by the program. If it is wrong, then the program will claim the points for itself. This increases the challenge for experienced players while lazy players or beginners can let the computer do all the work. A running total of games is also maintained.

User defined graphics

In the listing, user defined graphic characters within strings appear set up. The correct characters in all lines containing such strings are as follows:

```
5730"A A"
5740"A A"
5750"B B"
5775 AT 2,28; "E"; AT
19,28;"E"
7310 "GFJIK"
7315 "HCDS"
7320 "A23456789TJQK"
```

The program's strategy

There are essentially two phases in a round of cribbage where the program must make intelligent decisions. The first is when 2 cards have to be discarded into the crib. Here the program considers all permutations of 4 cards chosen from 6 and calculates the value of each hand using the normal scoring routine with some variation in parameters. An evaluation of the 2 cards for the crib is also performed. There are 15 such possibilities and evaluation of each takes just over 1 second, so the program takes about 20 seconds to make its decision.

The second phase is when the cards are played alternately, keeping a running total. Here the program considers the score which can be achieved for each card and varies it according to some rules of thumb, and if appropriate, a random factor. This heuristic approach seems to work well, but can occasionally lead to unpredictable play. However, few people want to play an entirely predictable opponent.

Those interested in seeing these processes at work should interrupt the program and set the variable debug to 1. The meaning of the information printed should be clear from a study of the program listing.

Program structure

The program is written entirely in Sinclair BASIC, but care in the structuring of the program has ensured that the execution speed is reasonable. Variables have been declared in an order which minimises the access time for those most frequently occuring, and the time critical routines have been placed early in the code. To aid clarity, all major subroutines are named in variables (lines 7100-7210) and are clearly separated in the listing by REM statements.

Data structure

The pack is represented by an array of 52 numbers p( ). The integer part of each number is the card's rank (1-13) and the fractional part, the suit (0.1-0.4). The array is randomly reordered during shuffling.

The other arrays used are as follows:

Human hand	:	a( )hold the card rank (1-13) a$( ) holds the suit (graphic form) b( ) work array
ZX hand	:	c( ) rank c$( ) suit d( ) work array
Crib	:	e( ) rank e$( ) suit
Internal	:	h( ) rank h$( ) suit i( ) work array t( ) table s( ) score

The work arrays often contain the value of a card, where ranks 10 have a value of 10, to speed up culculations. All scoring is calculated by copying a hand into the internal arrays h, i and h$ in order to preserve the original values on return. The usage of other variables should be clear from the subroutine descriptions.

Description of main subroutines

Many routines access the arrays detailed above in addition to the parameters listed below.

550 PICK2
Each combination of 4 cards chosen from 6 is evaluated using EVALHAND and certain other criteria, to determine the best cards to retain.
enter: ZX hand in c( ) d( ) c$( )
exit: t(1) and t(2) contain the positions of the cards to discard.

1000 EVALHAND
This routine returns the true score for a hand when called by SHOWS with c = 5. When c = 4 an estimation of the value is returned for PICK2.

enter:	c	= no of cards in hand (4,5)
	rlen	= minimum length of a run (2,3)
	tot	= sum of cards in hand
	h( ), i( ), h$( )	hand to be counted
	crib	= 1 if counting crib
exit:	p	= score for pairs
	f	= score for fifteens
	s	= score for sequences (runs)
	f1	= score for flush

2000 LAYCARD

If it is legal to do so, card c is added to the array representing the table and the new total and score is returned.

enter: c = card to be played
tot = current total
t( ) cards already on table
n = number of cards on table
exit: s = score (negative if illegal)
t = new total
t( ) and n are updated

2400 SORT
Bubble sort of hand in h( ) of length l.

2700 MANPLAY
The human player is asked to play a card. Exit is via TOTAL routine.
enter: nh = no. of cards played from hand
a( ),a$( ) = cards in hand
b( ) = 0 if card has been played
exit: hgo = 1 if no card can be played
win = man if reached 121 points

2900 TOTAL
The new running total is displayed and the score is updated if necessary.
enter: tot = running total
s = score
player = ZX or Man

3200 ZXPLAY
The computer considers the effect of playing each of the cards in its hand by calling LAYCARD and applying some heuristic knowledge. The best card is then played. Exit is via the TOTAL routine.
enter: nc = no. of cards played from hand
c( ),c$( ) = cards in hand
d( ) = 0 if card has been played
exit: cgo = 1 if computer cannot play

3700 SELECT
The human player selects a card using the space and enter keys.
enter: c = number of cards to choose from
exit: x = number of card selected

4000 TAKETURNS
The routines MANPLAY and ZXPLAY are called alternately until all cards have been played or a winner has been found. The subroutine at 3400 is used to turn the cards over when a total of 31 has been reached. 4400 resets the total to 0.
enter: dir = dealer (ZX or Man)
exit: done = 1 if all cards played
win = player if a player has won

4500 SHOW
The hands are displayed on the screen and their score determined, starting with the non-dealer and finishing with the crib.

4700 COUNT
Prints the score for a hand on the screen.
If muggin's rule is in force, the player is asked to enter his own score.
enter: mug = 1 if muggin's rule
h( ), h$( ) = hand to count

4900 CUT
The pack is cut by either ZX or Man depending on the variable player. The card is displayed and made the 5th card in each card.
enter: x = horizontal position of pack
exit: k = rank of card
k$ = suit of card

5000 MANHAND
Display the human's hand on the screen.
enter: y = vertical position on screen
c = number of cards in hand

5100 ZXHAND
Display the computer's hand on the screen.
enter: up = 1 if hand to be shown faceup
c = number of cards in hand

5200 CRIBHAND
Display the crib on the screen and copy it from e( ) and into h( ) ready for COUNT.
enter: dlr determines location on screen

5300 ERASE
Remove a card from the screen.
enter: x = card position (1 to 6)
y = vertical screen position

5350 FACEDOWN
Print a facedown card.
enter: x = card position (1 to 6)
y = vertical screen position

5400 FACEUP
Print a card faceup.
enter: x = card position
y = vertical position
x$ = rank
y$ = suit

5500 MESSAGE
Print a message in lower part of screen.
enter: m$ = message

5600 CLEAR
Clear left hand side of screen.
enter: x = width to clear

5700 DRAWBOARD
Draw the crib board down the right hand side of the screen.

6000 UPDATE
Update the score on the crib board.
enter: s = score
player = player who has scored
exit: win = player if score 120

Description of main program

7000 INITIALISATION
Arrays are DIMmed, user graphics defined, variables loaded and the pack constructed.

7400 START GAME
Clear scores and cut for deal.

7500 SHUFFLE AND DEAL
The pack is randomly shuffled then the cards to be dealt are sorted to make life easier for everyone later.

7800 DISCARD CARDS
The computer calls PICK2 to discard 2 cards then SELECT is called twice for the human to do the same. Afterwards the arrays are rearranged to remove gaps.

8000 PLAY A ROUND
First CUT is called to complete the hand before TAKETURNS and SHOW are called to actually play the round.

8200 WINNER
Congratulate the winner, update the score in games, and restart.

9000 INSTRUCTIONS
Variable i$ controls whether or not instructions are printed.

9600 GRAPHICS DATA

9990 MICRODRIVE routines for saving program.

```
   1 REM **************************
         *Underlined characters*
         *are entered in       *
         *GRAPHICS mode.       *
         **************************
  40 DEF FN t(x)=(x>9)*10+(x<10)
*x
  50 DEF FN s(x)=10*(x-INT (x))
  60 GO TO 7000
 500 REM ==========================
============= PICK 2 CARDS
```

```
 51Ø PRINT AT 7,8; FLASH 1;"THIN
KING";AT Ø,Ø;
 565 FOR i=1 TO 5
 57Ø FOR j=i+1 TO 6
 575 LET y=1: LET tot=Ø: LET f5=
Ø
 58Ø FOR x=1 TO 6
 585 IF x=i OR x=j THEN  GO TO 6
1Ø
 59Ø LET h(y)=c(x): LET i(y)=d(x
): LET h$(y)=c$(x): LET tot=tot+
i(y)
 595 IF i(y)=5 THEN  LET f5=f5+1
 6ØØ LET y=y+1
 61Ø NEXT x
 62Ø GO SUB EVALHAND
 63Ø LET s=s+p+f+f1+f5: LET cr=Ø
 64Ø IF c(j)=c(i) OR c(j)=c(i)+1
 THEN  LET cr=2
 645 IF c(i)=5 OR d(j)=5 THEN  L
ET cr=cr+2
 65Ø IF d(i)+d(j)=15 THEN  LET c
r=cr+2
 652 IF debug THEN  PRINT : FOR
q=1 TO 4: PRINT h(q);" ";: NEXT
q: PRINT ,s;" ";cr;"   ";
 655 IF dlr=1 THEN  LET s=s+cr:
GO TO 665
 66Ø LET s=s-cr
 665 IF s>max THEN  LET max=s: L
ET t(1)=i: LET t(2)=j: IF debug
THEN  PRINT "x";
 67Ø NEXT j: NEXT i
 675 LET y=Ø
 68Ø LET x=t(1): GO SUB ERASE
 685 LET x=t(2): GO SUB ERASE
 69Ø PRINT AT 7,8;" READY  "
 695 RETURN
1ØØØ REM =======================
=========== EVALUATE A HAND


1Ø7Ø LET p=Ø: LET f=Ø: LET f1=4
111Ø IF tot=15 THEN  LET f=2
112Ø FOR x=1 TO c-1
113Ø FOR y=x+1 TO c
114Ø IF h(x)=h(y) THEN  LET p=p+
2
115Ø IF i(x)+i(y)=15 THEN  LET f
=f+2
1155 IF c<5 THEN  GO TO 122Ø
116Ø LET t=Ø
117Ø FOR z=1 TO c
118Ø IF z=x OR z=y THEN  GO TO 1
2ØØ
119Ø LET t=i(z)+t
12ØØ NEXT z
121Ø IF t=15 THEN  LET f=f+2
122Ø NEXT y: NEXT x
124Ø FOR x=1 TO 4
125Ø IF tot-i(x)=15 THEN  LET f=
f+2
126Ø IF h$(x)<>h$(1) THEN  LET f
1=Ø
127Ø NEXT x
128Ø IF c=4 THEN  GO TO 14ØØ
129Ø IF tot-i(5)=15 THEN  LET f=
f+2
13ØØ IF f1=4 AND h$(5)=h$(1) THE
N  LET f1=5
131Ø IF f1=4 AND crib=1 THEN  LE
T f1=Ø: REM flush in crib must b
e 5 cards
14ØØ LET x=1: LET s=Ø
141Ø IF x>3 THEN  RETURN
142Ø LET r=1: LET d=1
143Ø IF h(x+1)=h(x)+1 THEN  LET
r=r+1: GO TO 149Ø
144Ø IF h(x+1)>h(x) THEN  GO TO
147Ø
145Ø LET d=d+1: IF d<>3 THEN  GO
 TO 149Ø
1455 IF h(x-1)<>h(x) THEN  LET d
=4
146Ø GO TO 149Ø
147Ø IF r>rlen THEN  LET s=s+d*r
: IF r=2 THEN  LET s=s-d
148Ø LET x=x+1: GO TO 141Ø
149Ø LET x=x+1: IF x<c THEN  GO
TO 143Ø
15ØØ IF r>rlen THEN  LET s=s+d*r
: IF r=2 THEN  LET s=s-d
151Ø RETURN
2ØØØ REM =======================
=========== LAY CARD ON TABLE

2ØØ5 LET p=Ø: LET s=Ø
2ØØ8 LET ct=FN t(c)
2Ø1Ø IF tot+ct>31 THEN  LET s=-1
: RETURN
2Ø15 LET n=n+1: LET t(n)=c
2Ø2Ø LET t=tot+ct: IF t=15 OR t=
31 THEN  LET s=2
2Ø22 IF n=1 THEN  RETURN
2Ø25 IF ABS (t(n-1)-c)>=n THEN
RETURN
2Ø26 REM *** any pairs?
2Ø3Ø FOR x=n-1 TO 1 STEP -1
2Ø4Ø IF t(n)<>t(x) THEN  GO TO 2
1ØØ
2Ø5Ø LET p=p+2
2Ø6Ø NEXT x
21ØØ IF p=6 THEN  LET p=12
211Ø IF p=4 THEN  LET p=6
2115 LET s=s+p
212Ø IF p>Ø THEN  RETURN
213Ø REM *** no pairs,check runs
22ØØ IF n<3 THEN  RETURN
```

```
2210 FOR l=3 TO n
2220 LET y=1
2230 FOR x=n-l+1 TO n
2240 LET h(y)=t(x): LET y=y+1
2250 NEXT x
2270 GO SUB SORT
2330 LET r=1
2340 FOR x=1 TO l-1
2350 IF h(x)+1<>h(x+1) THEN  GO
TO 2380
2360 NEXT x
2370 IF r>p THEN  LET p=r
2380 NEXT l
2385 LET s=s+p
2390 RETURN
2400 REM ======================
============ SORT H(), length l

2410 LET z=0
2420 FOR x=1 TO l-1
2430 IF h(x)>h(x+1) THEN  LET z=
h(x): LET h(x)=h(x+1): LET h(x+1
)=z
2440 NEXT x
2450 IF z<>0 THEN  GO TO 2410
2460 RETURN
2700 REM ======================
============ MANPLAY human plays
 a card
2710 IF nh=4 THEN  LET hgo=1: PR
INT AT 6,9;" GO      ": RETURN
2715 LET m$="Select a card using
 SPACE+ENTER": GO SUB MESSAGE
2720 LET c=4: LET x=1: GO SUB SE
LECT
2740 IF b(x)<>0 THEN  GO TO 2765
2742 IF tot<22 THEN  GO TO 2720
2745 PRINT AT 20,x*4-4;"GO?"
2747 LET m$="ENTER again if you
can't play.": GO SUB MESSAGE
2750 LET hgo=x: GO SUB SELECT
2755 PRINT AT 20,hgo*4-4;"   ";
2760 IF hgo<>x THEN  GO TO 2740
2762 IF tot<safe THEN  LET safe=
tot
2763 RETURN
2765 LET k=x: BEEP .02,15
2770 LET c=a(k): GO SUB LAYCARD
2775 IF s<0 THEN  BEEP .2,20: LE
T m$="Total must be less than 32
": GO SUB MESSAGE: GO TO 2720
2780 LET nh=nh+1
2785 LET tot=t: LET b(k)=0
2790 LET x=k: LET y=16
2800 GO SUB ERASE
2820 LET x=nh: LET y=8
2830 LET x$=r$(c): LET y$=a$(k)
2840 GO SUB FACEUP
2850 LET player=man
2900 REM ======================
============ TOTAL AND SCORE

2910 PAPER 4
2920 PRINT AT 6,0;"TOTAL ";tot;"
 "
2930 IF s=0 THEN  RETURN
2940 PRINT AT 6,9;"for ";s;" "
2955 GO SUB UPDATE
2960 RETURN
3200 REM ======================
============ ZX PLAYS A CARD

3220 IF nc=4 THEN  LET cgo=1: RE
TURN
3225 LET m$="": GO SUB MESSAGE
3230 IF debug=1 THEN  PRINT #1;A
T 0,0;n$;AT 0,0;
3240 LET max=-9: LET x1=0
3250 FOR i=1 TO 4
3260 IF d(i)<0 THEN  GO TO 3500:
 REM already played
3270 LET c=c(i)
3280 GO SUB LAYCARD: IF s<0 THEN
  GO TO 3500: REM illegal
3290 LET n=n-1: LET i(i)=s: REM
unplay and save score
3300 REM special rules
3305 IF t+c=31 AND t<safe THEN
LET s=s-1
3310 LET s=s+(t>15)-(t=21)+(t>=s
afe)-2*(t=5)
3315 IF n>0 THEN  GO TO 3400
3320 FOR j=1 TO 4
3330 IF i=j OR d(j)<0 THEN  GO T
O 3360
3340 IF t<>5 AND t+d(j)=15 THEN
 LET s=s+2
3350 IF ABS (c-c(j))<2 THEN  LET
 s=s+2
3360 NEXT j
3380 GO TO 3450
3400 IF ABS (t(n)-c)>2 THEN  GO
TO 3450
3410 FOR j=1 TO 4
3420 IF j=i OR d(j)<0 THEN  GO T
O 3440
3430 IF ABS (t(n)-c(j))<=2 THEN
 IF t+2*d(i)<32 THEN  LET s=s+2
3440 NEXT j
3450 LET s=s+(RND>.6)
3460 IF s>=max THEN  LET max=s:
LET x1=i
3490 IF debug THEN  PRINT #1;c;"
=";i(i);",";s;"  ";
3500 NEXT i
3550 IF x1=0 THEN  LET cgo=1: PR
INT AT 6,9;" GO      ": RETURN
3560 LET c=c(x1): LET t=tot+FN t(c)
```

```
3570 LET n=n+1: LET t(n)=c
3580 LET tot=t: LET s=i(x1)
3590 LET nc=nc+1: LET d(x1)=-9
3600 LET x=nc: LET y=0
3610 LET x$=r$(c): LET y$=c$(x1)
3620 BEEP .02,12: GO SUB FACEUP
3630 LET player=zx
3640 GO TO TOTAL
3700 REM ======================
============ SELECT CARD


3710 PAPER 4
3720 PRINT AT 21,x*4-3; FLASH 1;
"^";
3725 IF INKEY$<>"" THEN  GO TO 3
725
3730 IF CODE INKEY$=13 THEN  GO
TO 3800
3750 IF INKEY$<>" " THEN  GO TO
3730
3760 PRINT AT 21,x*4-3;" ";
3770 LET x=x+1: IF x>c THEN  LET
 x=1
3790 GO TO 3720
3800 PRINT AT 21,x*4-3;" ";
3810 RETURN
4000 REM ======================
============ TAKE TURNS

4050 LET nh=0: LET nc=0
4065 LET safe=31
4080 GO SUB 4400
4090 IF dlr<>zx THEN  GO TO 4200
4100 REM human
4110 IF done=1 THEN  RETURN
4120 GO SUB MANPLAY
4125 IF win>0 THEN  RETURN
4130 IF tot=31 THEN  GO SUB 4300
: GO TO 4200
4140 IF cgo=0 THEN  GO TO 4200
4150 IF hgo=0 THEN  GO TO 4100
4160 LET s=1: GO SUB TOTAL: IF w
in>0 THEN  RETURN
4170 GO SUB 4300
4200 REM computer
4205 IF done=1 THEN  RETURN
4210 GO SUB ZXPLAY
4220 IF win>0 THEN  RETURN
4230 IF tot=31 THEN  GO SUB 4300
: GO TO 4100
4240 IF hgo=0 THEN  GO TO 4100
4250 IF cgo=0 THEN  GO TO 4200
4260 LET s=1: GO SUB TOTAL: IF w
in>0 THEN  RETURN
4270 GO SUB 4300
4290 GO TO 4100
4300 REM *** turn over ***
4310 LET y=0
4320 FOR x=1 TO nc
4325 GO SUB FACEDOWN
4330 NEXT x
4340 LET y=8
4350 FOR x=1 TO nh
4360 GO SUB FACEDOWN
4370 NEXT x
4400 REM **** NEXT ROUND *****
4405 LET done=0: LET s=0
4420 LET tot=0: LET n=0
4430 IF nh=4 AND nc=4 THEN  LET
done=1
4440 LET cgo=0: LET hgo=0
4450 GO SUB TOTAL: RETURN
4500 REM ======================
============ SHOW HANDS AND COUN
T
4510 PRINT #1;AT 0,0;n$;
4515 LET c=5: LET rlen=2
4520 LET x=18: GO SUB CLEAR
4530 IF dlr=zx THEN  GO TO 4600
4540 FOR x=1 TO 5
4550 LET h(x)=c(x): LET h$(x)=c$
(x)
4560 NEXT x
4570 LET up=1: LET c=4: GO SUB Z
XHAND
4575 LET m$="Counting my hand":
GO SUB MESSAGE
4580 LET player=zx: GO SUB COUNT
4585 IF win THEN  RETURN
4590 IF dlr=zx THEN  GO TO 4660
4600 LET m$="Counting your hand"
: GO SUB MESSAGE
4605 FOR x=1 TO 5
4610 LET h(x)=a(x): LET h$(x)=a$
(x)
4620 NEXT x
4625 LET c=4: LET y=11
4630 GO SUB MANHAND
4640 LET player=man: GO SUB COUN
T
4645 IF win THEN  RETURN
4650 IF dlr=zx THEN  GO TO 4540
4660 LET m$="Ready to see the cr
ib ? ": GO SUB MESSAGE
4661 PAUSE 0
4665 LET x=18: GO SUB CLEAR
4670 GO SUB CRIBHAND
4675 LET m$="Counting points in
the crib": GO SUB MESSAGE
4680 GO SUB COUNT
4690 RETURN
4700 REM ======================
============ COUNT HAND h()

4705 LET nob=0: LET tot=0
4710 FOR x=1 TO 5
4715 IF x<5 AND h(x)=11 AND h$(x
```

```
)=e$(5) THEN  LET nob=1
4720 LET i(x)=FN t(h(x))
4735 LET tot=tot+i(x)
4740 NEXT x
4750 LET l=5: GO SUB SORT
4760 LET c=5: GO SUB EVALHAND
4765 PRINT
4770 LET m$="": GO SUB MESSAGE
4775 IF player=zx OR NOT mug THE
N  GO TO 4820
4780 INPUT "What is your score?
";ss
4785 IF ss<0 OR ss>50 THEN  GO T
O 4780
4790 IF ss=s+p+f+fl+nob THEN  LE
T m$="I agree": LET s=ss: GO TO
4880
4795 LET m$=STR$ ss+" is WRONG,
I get the points!"
4800 LET mug=2: LET player=zx
4820 PAPER 4
4830 IF f>0 THEN  PRINT "15s  -
";f;"   ";
4840 IF p>0 THEN  PRINT "pairs-
";p;
4845 PRINT
4850 IF fl>0 THEN  PRINT "flush-
 ";fl;"   ";
4860 IF s>0 THEN  PRINT "runs -
";s;
4865 PRINT
4870 IF nob=1 THEN  PRINT "and 1
 for his nob"
4875 LET s=s+p+f+fl+nob
4880 PRINT "TOTAL = ";s;
4885 IF mug=2 THEN  PRINT " for
me!"
4890 GO SUB MESSAGE: GO SUB UPDA
TE
4891 IF mug=2 THEN  LET player=m
an: LET mug=1: PAUSE 100
4895 RETURN
4900 REM =======================
============ CUT PACK make it 5t
h in hands
4905 LET y=8: GO SUB FACEDOWN
4910 LET m$="Now I cut the pack.
"
4915 IF player=man THEN  GO SUB
MESSAGE: PAUSE 50: GO TO 4930
4920 LET m$="Press any key to cu
t the pack.": GO SUB MESSAGE
4925 IF INKEY$="" THEN  GO TO 49
25
4930 LET r=RND*40+12.5
4935 LET k=INT p(r)
4940 IF k=s THEN  GO TO 4930
4945 LET k$=s$(FN s(p(r)))
4950 LET x$=r$(k): LET y$=k$
4955 LET x=x-.25: LET y=7
4960 GO SUB FACEUP
4965 LET a(5)=k: LET a$(5)=k$
4970 LET c(5)=k: LET c$(5)=k$
4975 LET e(5)=k: LET e$(5)=k$
4980 RETURN
4985 LET e(5)=k: LET e$(5)=k$
5000 REM =======================
============ DISPLAY HUMAN HAND

5020 FOR x=1 TO c
5030 LET x$=r$(a(x)): LET y$=a$(
x)
5040 GO SUB FACEUP
5050 NEXT x: RETURN
5100 REM =======================
============ DISPLAY ZX HAND

5110 LET y=0
5120 FOR x=1 TO c
5130 LET x$=r$(c(x)): LET y$=c$(
x)
5150 GO SUB FACEUP
5170 NEXT x: RETURN
5200 REM =======================
============ DISPLAY CRIB and co
py to h()
5210 LET crib=1: LET y=11: IF dl
r=zx THEN  LET y=0
5220 FOR x=1 TO 5
5230 LET h(x)=e(x): LET h$(x)=e$
(x)
5240 LET x$=r$(e(x)): LET y$=e$(
x)
5250 IF x<5 THEN  GO SUB FACEUP
5270 NEXT x: RETURN
5300 REM =======================
============ ERASE CARD

5310 PAPER 4: GO TO 5370
5350 REM =======================
============ PRINT FACEDOWN CARD

5360 PAPER 2
5370 LET x$=" ": LET y$=x$: GO T
O 5420
5400 REM =======================
============ PRINT FACEUP CARD

5410 PAPER 7: IF y$=s$(1) OR y$=
s$(3) THEN  INK 2
5420 LET x1=4*x-4
5440 PRINT AT y,x1;x$;"   ";AT y+
1,x1;y$;"   "
5450 PRINT AT y+2,x1;"    ";AT y+
3,x1;"  ";y$
5460 PRINT AT y+4,x1;"   ";x$
5470 PAPER 4: INK 0: RETURN
5500 REM =======================
```

```
============ PRINT MESSAGE

5510 PRINT #1;AT 1,0;n$;AT 1,0;m
$
5520 RETURN
5600 REM =======================
============ CLEAR THE SCREEN

5630 PAPER 4: PRINT AT 0,0;
5650 FOR y=1 TO 22: PRINT TAB x:
 NEXT y
5690 PRINT AT 0,0: RETURN
5700 REM =======================
============ DRAW CRIB BOARD

5710 PRINT AT 0,25; PAPER 6;"You
  ZX"
5715 PRINT TAB 25; PAPER 6;"
  "
5720 FOR y=1 TO 6
5730 PRINT TAB 25; PAPER 6;" ::
 :: ": REM GRAPHICS
5740 PRINT TAB 25; PAPER 6;" ::
 :: ": REM GRAPHICS
5750 PRINT TAB 25; PAPER 6;" ··
 ·· ": REM GRAPHICS
5760 NEXT y
5765 PRINT TAB 25; PAPER 6;"
  "
5770 PRINT n$;: PAPER 6
5775 PRINT AT 2,28;"··";AT 19,28;
"··": REM GRAPHICS
5780 LET m$="CRIBBAGE"
5790 FOR x=1 TO 8
5800 PRINT AT 2*x+1,28;m$(x)
5810 NEXT x
5820 PRINT AT 1,0;: PAPER 4: RET
URN
6000 REM =======================
============ UPDATE SCORE

6005 IF s=0 THEN  RETURN
6010 BEEP .2,10
6015 IF s=0 THEN  RETURN : REM e
ntry for demo routine
6020 LET ss=v(player)
6030 IF ss>0 THEN  GO SUB 6400
6040 LET v(player)=s(player)
6050 LET s(player)=s(player)+s
6060 IF s(player)>120 THEN  LET
win=player: GO TO 6085
6070 LET ss=s(player)
6080 GO SUB 6400
6085 PRINT  PAPER 6;AT 20,25;s(m
an)
6090 PRINT  PAPER 6;AT 20,31-(s(
zx)>99)-(s(zx)>9);s(zx)
6095 RETURN
6400 LET x=25: LET v=1
6405 IF player=zx THEN  LET x=31
: LET v=3
6410 IF ss>60 THEN  LET ss=ss-60
6415 IF ss<31 THEN  LET ss=31-ss
: GO TO 6440
6420 LET ss=ss-30: LET x=27: LET
 v=3: IF player=zx THEN  LET x=2
9: LET v=1
6440 LET y=1+(ss+INT ((ss-1)/5))
/2
6450 IF y<>INT y THEN  LET y=INT
 y+1: LET v=v+1
6460 PRINT  OVER 1; PAPER 6;AT y
,x;v$(v)
6490 RETURN
7000 REM ***********************
************ INITIALISATION

7005 RANDOMIZE : LET debug=0
7010 BORDER 4: PAPER 4: INK 0: C
LS
7020 LET x=0: LET y=0: LET z=0:
LET i=0: LET j=0
7025 DIM h(8): DIM h$(6): DIM i(
6)
7030 DIM a(6): DIM a$(6): DIM b(
6): REM humans hand
7035 DIM c(6): DIM c$(6): DIM d(
6): REM zx hand
7040 DIM e(6): DIM e$(6):
     REM crib hand
7050 DIM g(2): DIM s(2): DIM v(2
): DIM v$(5): REM scoring
7055 DIM p(52): DIM t(12): REM p
ack and table
7060 INPUT "Welcome to CRIBBAGE.
""Do you want instructions ? ";
i$
7070 IF i$(1)="y" OR i$="Y" THEN
  GO SUB 9000: GO TO 7080
7075 PRINT #1;"Please wait for a
 few moments ."
7080 FOR x=1 TO 13: READ k$
7085 FOR y=0 TO 7: READ z
7090 POKE USR k$+y,z
7095 NEXT y: NEXT x
7100 LET PICK2     = 500
7105 LET EVALHAND  = 1000
7110 LET LAYCARD   = 2000
7115 LET SORT      = 2400
7120 LET MANPLAY   = 2700
7125 LET TOTAL     = 2900
7130 LET ZXPLAY    = 3200
7135 LET SELECT    = 3700
7140 LET TAKETURNS= 4000
7145 LET SHOW      = 4500
7150 LET COUNT     = 4700
7155 LET CUT       = 4900
7160 LET MANHAND   = 5000
```

```
7165 LET ZXHAND   = 5100
7170 LET CRIBHAND = 5200
7175 LET ERASE    = 5300
7180 LET FACEDOWN = 5350
7185 LET FACEUP   = 5400
7190 LET MESSAGE  = 5500
7195 LET CLEAR    = 5600
7200 LET DRAWBOARD= 5700
7210 LET UPDATE   = 6000
7220 REM
7300 LET zx=1: LET man=2
7305 REM ***** GRAPHICS *****
7310 LET v$="▄▀▄▀▌": REM PEGS
7315 LET s$="♥♣♦♠": REM SUITS
7320 LET r$="A2345678910JQK": REM
 RANKS
7330 LET n$="
                ": REM 32 spaces
7335 LET o$="Press any key to co
ntinue"
7340 IF i$="y" THEN  GO SUB 9050
7350 REM construct pack
7355 LET z=0
7360 FOR x=1 TO 13
7365 FOR y=.1 TO .4 STEP .1
7370 LET z=z+1: LET p(z)=x+y
7375 NEXT y
7380 NEXT x
7390 LET g(man)=0: LET g(zx)=0
7400 REM **********************
************ START A NEW GAME

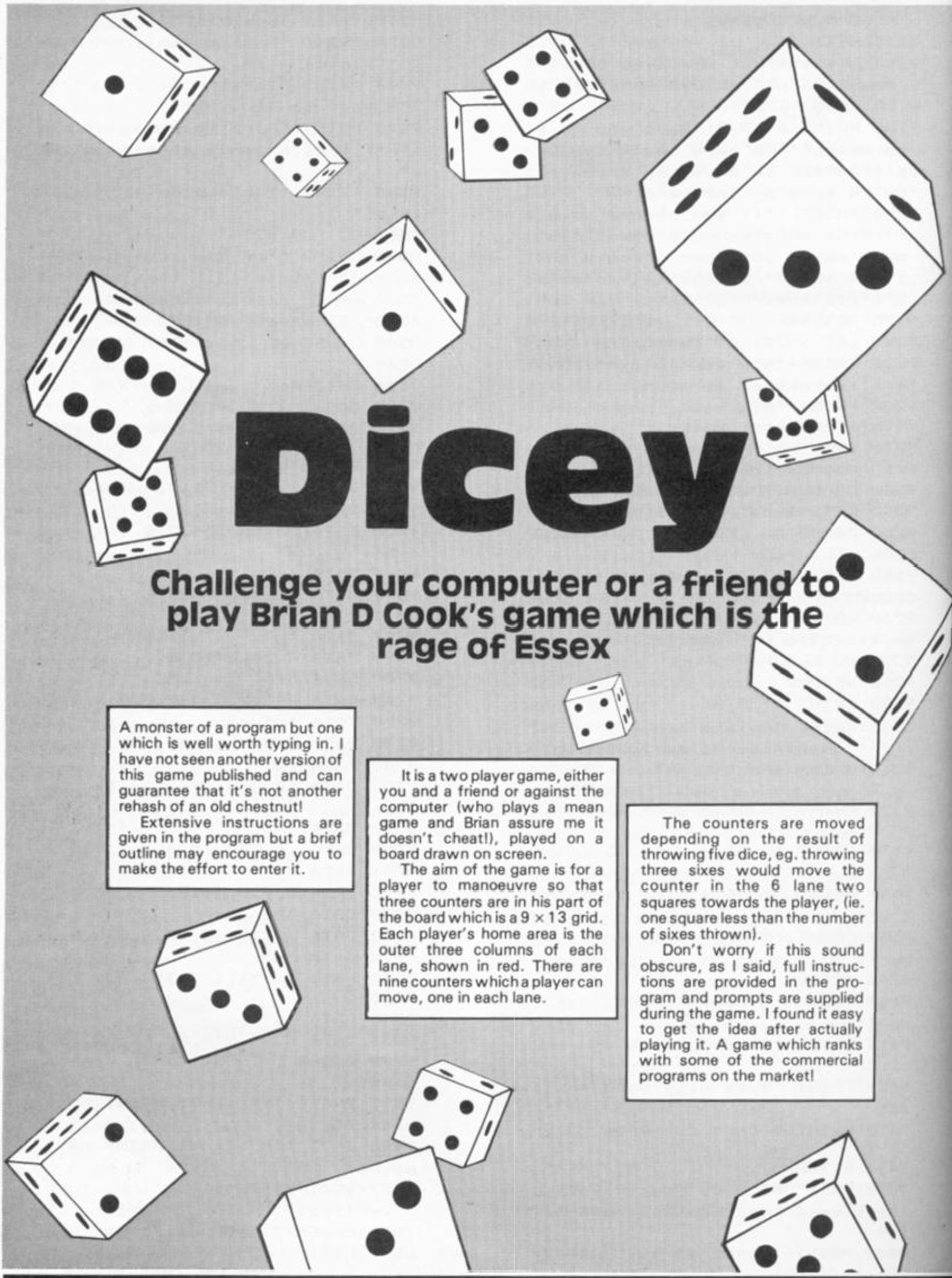
7404 LET mug=0
7405 INPUT "With muggins rule ?
 y/n ";m$: IF m$="y" OR m$="Y" T
HEN  LET mug=1
7406 GO SUB DRAWBOARD
7410 PRINT #1;AT 0,0;"Lowest cut
 deals."
7420 LET s(zx)=0: LET s(man)=0:
LET v(1)=0: LET v(2)=0
7425 LET dlr=zx: LET s=0: LET pl
ayer=zx: LET win=0
7430 LET x=2: GO SUB CUT: LET s=
k
7435 PAUSE 50
7440 LET player=man: LET x=5: GO
 SUB CUT
7450 IF s<k THEN  LET dlr=man
7470 PAUSE 50: LET x=23: GO SUB
CLEAR
7500 REM **********************
************ SHUFFLE AND DEAL

7510 LET m$="I am"
7520 IF dlr=man THEN  LET m$="Yo
u are"
7525 LET m$=m$+" the dealer"
7530 PRINT #0;AT 0,0;m$;n$
7535 LET m$="Shuffling the pack"
7540 GO SUB MESSAGE
7610 FOR x=1 TO 51
7620 LET y=INT (RND*(53-x))+x: L
ET z=p(x): LET p(x)=p(y): LET p(
y)=z
7630 NEXT x
7635 LET m$="": GO SUB MESSAGE
7640 REM sort cards to be dealt
7650 FOR y=1 TO 7 STEP 6
7655 LET z=0
7660 FOR x=y TO y+4
7670 IF p(x)>p(x+1) THEN  LET z=
x: LET j=p(x): LET p(x)=p(x+1):
LET p(x+1)=j
7680 NEXT x: IF z>0 THEN  GO TO
7655
7690 NEXT y
7700 REM deal
7710 LET i=0: LET j=16
7720 IF dlr=zx THEN  LET i=16: L
ET j=0
7730 FOR x=1 TO 6
7740 LET y=i: GO SUB FACEDOWN
7750 LET c(x)=INT p(x): LET c$(x
)=s$(FN s(p(x)))
7760 LET d(x)=FN t(c(x))
7770 LET y=j: GO SUB FACEDOWN
7780 LET a(x)=INT p(x+6): LET a$
(x)=s$(FN s(p(x+6)))
7790 LET b(x)=1
7795 NEXT x
7799 REM **********************
************ DISCARD INTO CRIB
7800 LET c=6: LET y=16: GO SUB M
ANHAND
7805 IF debug THEN  GO SUB ZXHAN
D
7810 LET m$="Please wait while I
 pick 2 cards": GO SUB MESSAGE
7820 LET c=4: LET rlen=1: LET cr
ib=0
7825 LET max=-99: LET t(1)=1: LE
T t(2)=6
7830 GO SUB PICK2
7840 LET m$="Pick 2 cards using
SPACE+ENTER": GO SUB MESSAGE
7845 IF i$="y" THEN  GO SUB 9300
: GO SUB 9400
7850 LET c=6: LET y=16: LET x=1
7860 GO SUB SELECT: GO SUB FACED
OWN
7870 LET t(3)=x: GO SUB SELECT
7880 LET x$=r$(a(x)): LET y$=a$(
x)
7885 IF x=t(3) THEN  GO SUB FACE
UP: GO TO 7860
7890 LET t(4)=x: GO SUB FACEDOWN
7895 REM *** close up hands
```

```
7900 FOR x=1 TO 2
7905 LET e(x)=c(t(x)): LET e$(x)
=c$(t(x))
7910 LET c(t(x))=0
7915 LET e(x+2)=a(t(x+2)): LET e
$(x+2)=a$(t(x+2))
7920 LET a(t(x+2))=0
7925 NEXT x
7930 LET y=1: LET z=1
7935 FOR x=1 TO 6
7940 IF c(x)=0 THEN  GO TO 7955
7945 LET c(y)=c(x): LET d(y)=d(x
)
7950 LET c$(y)=c$(x): LET y=y+1
7955 IF a(x)=0 THEN  GO TO 7970
7960 LET a(z)=a(x): LET a$(z)=a$
(x): LET z=z+1
7970 NEXT x
7980 LET x=24: GO SUB CLEAR
7985 IF i$="y" THEN  GO SUB 9450
7990 PRINT #0;AT 0,0;n$
7999  REM **********************
************* PLAY CARDS
8000 LET s=0: LET player=dlr
8010 LET x=6: GO SUB CUT
8020 IF k=11 THEN  LET m$="2 for
 his heels": GO SUB MESSAGE: LET
 s=2: GO SUB UPDATE: PAUSE 40
8030 LET c=4
8040 LET y=16: GO SUB MANHAND
8050 GO SUB TAKETURNS
8060 IF win THEN  GO TO 8200
8065 IF i$="y" THEN  GO SUB 9200
8070 GO SUB SHOW
8080 IF win THEN  GO TO 8200
8100 LET m$="Ready for the next
hand ?": GO SUB MESSAGE
8105 IF INKEY$="" THEN  GO TO 81
05
8110 LET dlr=dlr+1: IF dlr>2 THE
N  LET dlr=1
8120 LET x=25: GO SUB CLEAR
8130 IF i$<>"y" THEN  GO TO 7500
8140 INPUT "Continue with instru
ctions?";i$
8150 IF i$="Y" THEN  LET i$="y"
8160 GO TO 7500
8200 REM ***********************
************ WINNER

8210 LET m$="Congratulations, yo
u have won !"
8220 IF win=zx THEN  LET m$="Har
d luck, I have won !"
8230 PRINT #1;AT 0,0;m$
8240 PRINT  PAPER 6;AT 18,28; FL
ASH 1;v$(5)
8250 FOR x=1 TO 60 STEP 2: BEEP
.02,x: NEXT x
8260 LET g(player)=g(player)+1
8265 LET m$=o$: GO SUB MESSAGE
8270 PAUSE 0
8280 LET x=23: GO SUB CLEAR
8290 PRINT AT 4,8;"SCORE";AT 5,7
;"________"
8300 PRINT AT 7,8;"You  ";g(man)
8310 PRINT AT 9,8;"ZX   ";g(zx)
8320 INPUT "Another game y/n ";m
$
8330 IF m$="n" OR m$="N" THEN  S
TOP
8380 GO TO 7400
9000 REM ***********************
************ INSTRUCTIONS
9005 LET i$="y"
9010 CLS : PRINT "  6 card Cribb
age is a game for 2 players. Eac
h is dealt 6 cards2 of which he
discards to form  a third hand (
the crib) which islater scored b
y the dealer. The 3 hands are co
mplimented by a   card cut from
the pack. "
9020 PRINT '"Ace always counts a
s 1 and all  court cards have a
value of 10."
9030 PRINT : PRINT "You will see
 during play how   points are g
ained for certain  card combina
tions, but first   we will see
how scoring is kept."
9040 RETURN
9060 LET m$=o$: GO SUB MESSAGE
9065 PAUSE 0
9070 CLS : GO SUB DRAWBOARD
9075 PRINT "When points are scor
ed"'"they are marked on the"
9080 PRINT "board with pegs."''"
The winner is the first"
9085 PRINT "to reach 121 points"
'"(twice round the board)."
9090 LET m$="Press SPACE for a d
emonstration.": GO SUB MESSAGE
9095 PAUSE 0: IF INKEY$<>" " THE
N  GO TO 9175
9100 LET s(man)=0: LET s(zx)=0
9105 LET m$="Watch my score...":
 GO SUB MESSAGE
9110 FOR i=zx TO man
9115 LET player=i: LET win=0
9120 LET s(player)=0: LET v(play
er)=0
9130 LET s=INT (RND*10): GO SUB
UPDATE+15
9140 IF win=0 THEN  GO TO 9130
9145 PRINT  PAPER 6;AT 18,28;v$(
5)
9150 LET m$="Now watch your scor
```

```
e": GO SUB MESSAGE
9155 NEXT i
9160 LET m$="Hit SPACE to see th
e demo again": GO SUB MESSAGE: G
O TO 9095
9180 PRINT AT 9,0;"When you have
 to select"'"a card use these ke
ys:"'"SPACE to move the arrow,"'
"ENTER to play the card."
9190 PRINT '"If you choose to pl
ay"'"the muggins rule then"'"you
 must count your own"'"score and
 I get your"'"points if you make
 a"'"mistake."
9195 RETURN
9200 LET x=25: GO SUB CLEAR
9210 PRINT "Now each player coun
ts"'"the number of points in"
9220 PRINT "his hand, beginning
with"'"the non-dealer."
9230 PRINT '"Afterwards the deal
er"'"counts the crib."'
9240 GO SUB 9305: GO SUB 9400
9245 LET m$=o$: GO SUB MESSAGE
9250 PAUSE 0: LET x=25: GO SUB C
LEAR
9255 LET x=6: LET y=8: GO SUB FA
CEDOWN
9260 LET x=x-.25: LET y=7: LET x
$=r$(c(5)): LET y$=c$(5)
9270 GO SUB FACEUP
9280 RETURN
9300 PRINT AT 0,0;
9305 PRINT "Points are scored fo
r  "'"combinations as follows:"'
9310 PRINT "Each total of 15 ...
.. 2"
9320 PRINT "2 of a kind (1 pair
)  2"
9330 PRINT "3 of a kind (3 pairs
)  6"
9340 PRINT "4 of a kind (6 pairs
) 12"
9350 PRINT "Run of 3 or more  1/
Card"
9360 RETURN
9400 PRINT "4 card flush .......
.. 4"
9410 PRINT "5 card flush .......
.. 5"
9420 PRINT "Jack with same suit
as"
9430 PRINT " card cut from pack
.. 1"
9440 RETURN
9450 PRINT AT 0,0;"Now we each p
lay a card"'"alternately until t
he"
9460 PRINT "total is as close to
 31";'";"as possible."
9470 PRINT "Points are scored if
:"''"Total = 15 ..... 2"
9480 PRINT "Total = 31 ..... 2"'
"Closest to 31 .. 1"''
9490 PRINT "Forming a run or a p
air";'";"with cards already on th
e"
9500 PRINT "table also scores po
ints:"''
9510 GO SUB 9320
9520 PRINT '"If you cannot play
a card"'"(total>31) then select"
'"an empty card position."
9530 LET m$=o$: GO SUB MESSAGE
9540 PAUSE 0: LET x=25: GO SUB C
LEAR
9590 RETURN
9600 DATA "a"
9610 DATA 0,195,195,0,0,195,195,
0
9620 DATA "b"
9630 DATA 0,195,195,0,0,0,0,0
9640 DATA "c"
9650 DATA 56,56,254,254,214,16,1
6,56
9660 DATA "d"
9670 DATA 16,56,124,254,254,124,
56,16
9680 DATA "e"
9690 DATA 0,24,24,0,0,0,0,0
9700 DATA "f"
9710 DATA 240,255,240,0,0,0,0,0
9720 DATA "g"
9730 DATA 0,0,0,0,240,255,240,0
9740 DATA "h"
9750 DATA 68,238,254,124,124,56,
16,16
9760 DATA "i"
9770 DATA 15,255,15,0,0,0,0,0
9780 DATA "j"
9790 DATA 0,0,0,0,15,255,15,0
9800 DATA "k"
9810 DATA 28,28,28,28,8,8,8,8
9820 DATA "s"
9830 DATA 16,56,124,254,254,146,
16,56
9840 DATA "t"
9850 DATA 0,76,210,82,82,82,76,0
9990 CLEAR : INPUT "prog name :
";n$
9995 ERASE "m";1;n$: PRINT n$;"
erased"
9996 SAVE *"m";1;n$: PRINT n$;"
saved"
9997 VERIFY *"m";1;n$: PRINT n$;
" verified"
9999 PAPER 7: BORDER 7: INK 0: C
LS : LIST
```



Dicey

Challenge your computer or a friend to play Brian D Cook's game which is the rage of Essex

A monster of a program but one which is well worth typing in. I have not seen another version of this game published and can guarantee that it's not another rehash of an old chestnut!

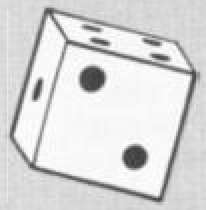
Extensive instructions are given in the program but a brief outline may encourage you to make the effort to enter it.

It is a two player game, either you and a friend or against the computer (who plays a mean game and Brian assure me it doesn't cheat!), played on a board drawn on screen.

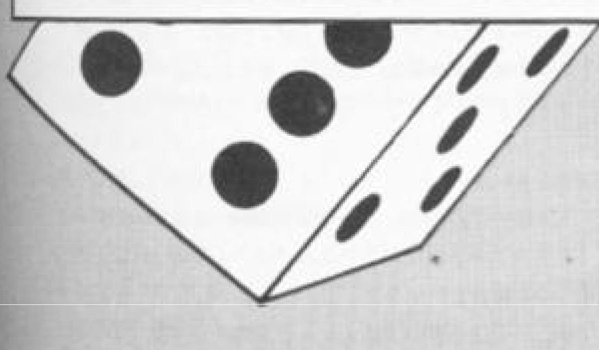
The aim of the game is for a player to manoeuvre so that three counters are in his part of the board which is a 9 × 13 grid. Each player's home area is the outer three columns of each lane, shown in red. There are nine counters which a player can move, one in each lane.

The counters are moved depending on the result of throwing five dice, eg. throwing three sixes would move the counter in the 6 lane two squares towards the player, (ie. one square less than the number of sixes thrown).

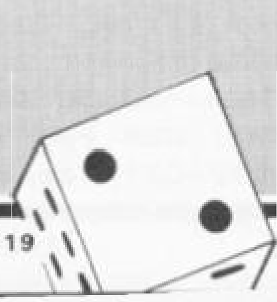
Don't worry if this sound obscure, as I said, full instructions are provided in the program and prompts are supplied during the game. I found it easy to get the idea after actually playing it. A game which ranks with some of the commercial programs on the market!



```
   1 REM ***********************
         *Underlined characters*
         *are entered in       *
         *GRAPHICS mode.       *
         ***********************
   4 BEEP .5,3: BEEP .35,Ø: CLS
 : PRINT AT 1Ø,3; INK 3; BRIGHT 1
 ;"DO YOU WANT INSTRUCTIONS?";AT
 12,6;"(PRESS 'y' OR 'n')"
   5 IF INKEY$="" THEN  GO TO 2
   6 POKE 23658,Ø: IF INKEY$="y"
 THEN  GO SUB 91ØØ: GO TO 5
   7 GO SUB 927Ø
   8 CLS : BORDER 1: INK Ø: PAPE
R 7
   9 PRINT AT 1Ø,Ø; FLASH 1; INK
 1; PAPER 6;"THE BOARD IS NOW BE
ING SET UP..."
  1Ø RESTORE 99Ø5: GO SUB 99ØØ:
REM  graphics
  15 RANDOMIZE
  2Ø DIM t(5): DIM r(5): DIM z$(
6): LET t$="\/": LET b$="/\"
  3Ø DIM d(5,2,1): FOR i=1 TO 5:
 FOR n=1 TO 2: READ p: LET d(i,n
,1)=p: NEXT n: NEXT i
  34 REM board co-ords & initial
 counter display
  35 DIM y(9): DIM x(13)
  4Ø FOR i=Ø TO 8: LET y(i+1)=2*
i: NEXT i
  5Ø FOR i=1 TO 7: LET x(i)=2*i:
 NEXT i: FOR i=8 TO 13: LET x(i)
=2*i+1: NEXT i
  6Ø LET e1=Ø: LET e2=Ø: DIM f(9
): FOR i=1 TO 9: LET f(i)=7: NEX
T i
  65 CLS : IF play=2 THEN  PRINT
 AT 1Ø,6; INK 1;"PLAYER ONE COMM
ENCES": PAUSE 75
  66 IF play=1 AND go=1 THEN  PR
INT AT 1Ø,6; INK 1;"SPECTRUM COM
MENCES": PAUSE 75
```



```
  67 IF play=1 AND go=-1 THEN  P
RINT AT 1Ø,6; INK 1;"O.K. - YOU
GO FIRST": PAUSE 75
  7Ø GO SUB 9ØØØ:      REM print
 board
  8Ø GO SUB 2ØØØ:      REM print
 dice & counters
  9Ø GO SUB 45ØØ: REM win check
 1ØØ LET go=go*-1
 2ØØ FOR n=1 TO 1Ø: FOR i=1 TO 5
: LET r(i)=1+INT (RND*6): NEXT i
 2Ø5 BEEP .Ø1,INT (RND*1Ø)
 21Ø GO SUB 35ØØ: NEXT n
 22Ø PRINT AT 21,Ø; INK 1; PAPER
 6;"          FIRST ROLL
   "
 23Ø IF play=2 OR go=1 THEN  GO
SUB 3ØØØ
 231 IF play=1 AND go=-1 THEN  G
O SUB 36ØØ: GO SUB 5ØØØ: GO SUB
55ØØ
 234 IF m=Ø THEN  GO TO 31Ø
 235 FOR n=1 TO 1Ø
 24Ø GO SUB 24ØØ
 25Ø GO SUB 35ØØ
 255 NEXT n
 26Ø PRINT AT 21,Ø; INK 1; PAPER
 6;"          SECOND ROLL
   "
 27Ø IF play=2 OR go=1 THEN  GO
SUB 3ØØØ
 271 IF play=1 AND go=-1 THEN  G
O SUB 36ØØ: GO SUB 5ØØØ: GO SUB
55ØØ
 274 IF m=Ø THEN  GO TO 31Ø
 275 FOR n=1 TO 1Ø
 28Ø GO SUB 24ØØ
 29Ø GO SUB 35ØØ
 295 NEXT n
 3ØØ PRINT AT 21,Ø; INK 1; PAPER
 6;"          THIRD ROLL
   "
 31Ø GO SUB 36ØØ
 315 IF play=1 AND go=-1 THEN  G
O SUB 63ØØ
 32Ø PRINT AT 21,Ø;x$
 33Ø PRINT #1; INK 6;"Press any
key to continue"
```





```
 34Ø PAUSE Ø: CLS
 35Ø IF go=-1 THEN  GO TO 37Ø
 36Ø IF play=2 THEN  PRINT  INK
1;AT 21,Ø;"            PLAYER ONE
 "
 361 IF play=1 THEN  PRINT  INK
1;AT 21,Ø;"              SPECTRUM
 "
 365 GO TO 7Ø
 37Ø IF play=2 THEN  PRINT  INK
2;AT 21,Ø;"            PLAYER TWO
 "
 371 IF play=1 THEN  PRINT  INK
2;AT 21,Ø;"              YOURSELF
 "
 38Ø GO TO 7Ø
2ØØØ REM dice & counter plotting
2Ø1Ø FOR i=1 TO 5: PLOT d(i,1,1)
,d(i,2,1): DRAW 16,Ø: DRAW Ø,-16
: DRAW -16,Ø: DRAW Ø,16: PRINT
BRIGHT 1; INK Ø; PAPER 4;AT 19,6
*(i-1);i;"-": NEXT i
2Ø2Ø FOR i=1 TO 9
2Ø25 IF i=e1 OR i=e2 THEN  NEXT
i
2Ø26 IF i=1Ø THEN  GO TO 2Ø4Ø
2Ø3Ø PRINT  OVER 1; INK 1; PAPER
 6;AT y(i),x(f(i));t$;AT y(i)+1,
x(f(i));b$: NEXT i
2Ø4Ø IF NOT e1 AND NOT e2 THEN
RETURN
2Ø5Ø LET disp1=disp1*go: LET dis
p2=disp2*go
2Ø6Ø LET f(e1)=f(e1)+disp1
2Ø7Ø IF f(e1)<1 THEN  LET f(e1)=
1
2Ø8Ø IF f(e1)>13 THEN  LET f(e1)
=13
2Ø9Ø PRINT  OVER 1; INK 1; PAPER
 6;AT y(e1),x(f(e1));t$;AT y(e1)
+1,x(f(e1));b$
21ØØ IF NOT e2 THEN  RETURN
211Ø LET f(e2)=f(e2)+disp2
212Ø IF f(e2)<1 THEN  LET f(e2)=
1
213Ø IF f(e2)>13 THEN  LET f(e2)
=13
214Ø PRINT  OVER 1; INK 1; PAPER
 6;AT y(e2),x(f(e2));t$;AT y(e2)
+1,x(f(e2));b$
215Ø RETURN
24ØØ REM reset dice values
241Ø FOR i=1 TO m: LET r(t(i))=1
+INT (RND*6): NEXT i
242Ø BEEP .Ø1,INT (RND*1Ø)
243Ø RETURN
2999 REM re-roll
3ØØØ LET r$="": INPUT "Enter y i
f O.K. or n if not "; LINE r$
3Ø1Ø IF r$<>"y" AND r$<>"n" THEN
  GO TO 3ØØØ
3Ø2Ø IF r$="y" THEN  GO TO 31Ø
3Ø3Ø INPUT "How many dice for re
-roll? ";m
3Ø4Ø LET m=INT m: IF m<1 OR m>5
THEN  GO TO 3Ø3Ø
3Ø45 PRINT #1; FLASH 1; INK 2; P
APER 7;"Enter the re-roll dice n
os....": PAUSE 125
3Ø5Ø FOR i=1 TO m: INPUT "Dice n
o ";INT i;" for re-roll? ";t(i):
 LET t(i)=INT t(i)
3Ø55 IF t(i)<1 OR t(i)>5 THEN  G
O TO 3Ø5Ø
3Ø6Ø NEXT i: RETURN
3499 REM print dice values
35ØØ FOR i=1 TO 5: PRINT AT 19,6
*i-3; INK 7; PAPER Ø;r(i): NEXT
i
351Ø RETURN
3599 REM sort dice values
36ØØ FOR n=1 TO 4: FOR i=1 TO 5-
n
361Ø IF r(i)<r(i+1) THEN  LET a=
r(i): LET r(i)=r(i+1): LET r(i+1
)=a
362Ø NEXT i: NEXT n
3629 REM hold how many of each
 dice value
363Ø DIM v(5,2): LET count=1: LE
T a=Ø
364Ø FOR n=1 TO 5
365Ø IF n=5 THEN  GO TO 37ØØ
366Ø FOR i=n TO 4
367Ø IF r(i)=r(i+1) THEN  LET co
unt=count+1: GO TO 369Ø
368Ø GO TO 37ØØ
369Ø NEXT i
37ØØ LET a=a+1: LET v(a,2)=count
: LET v(a,1)=r(n)
371Ø LET n=n+count-1: LET count=
1
372Ø NEXT n
3789 REM set x$ to dice comb.
& set counter movement markers
379Ø DIM x$(32): LET e1=Ø: LET e
2=Ø: LET disp1=Ø: LET disp2=Ø
38ØØ IF v(1,2)<>5 THEN  GO TO 38
2Ø
38Ø1 REM fives
38Ø2 LET x$="FIVE "+STR$ v(1,1)+
"'s!!"
38Ø4 LET disp1=v(1,2)-1: LET e1=
v(1,1): GO TO 393Ø
382Ø IF v(1,2)<>4 AND v(2,2)<>4
THEN  GO TO 383Ø
3821 REM fours
3822 LET disp1=3: IF v(1,2)=4 TH
```

```
EN  LET e1=v(1,1)
3823 IF v(2,2)=4 THEN  LET e1=v(
2,1)
3824 LET x$="FOUR "+(STR$ v(1,1)
 AND v(1,2)=4)+(STR$ v(2,1) AND
v(2,2)=4)+"'s": GO TO 393Ø
383Ø IF v(1,2)<>3 AND v(1,2)<>2
OR v(2,2)<>3 AND v(2,2)<>2 OR v(
1,2)=v(2,2) THEN  GO TO 385Ø
3834 REM full house
3835 LET x$="FULL HOUSE:3 "+(STR
$ v(1,1) AND v(1,2)=3)+(STR$ v(2
,1) AND v(2,2)=3)+"'s&2 "+(STR$
v(1,1) AND v(1,2)=2)+(STR$ v(2,1
) AND v(2,2)=2)+"'s"
3838 FOR i=1 TO 2
384Ø IF v(i,2)=3 THEN  LET disp1
=v(i,2)-1: LET e1=v(i,1)
3843 IF v(i,2)=2 THEN  LET disp2
=v(i,2)-1: LET e2=v(i,1)
3845 NEXT i: GO TO 393Ø
3849 REM threes
385Ø FOR i=1 TO 3: IF v(i,2)=3 T
HEN  LET disp1=v(i,2)-1: LET e1=
v(i,1): LET x$="THREE "+STR$ v(i
,1)+"'s"
3851 NEXT i
3854 REM pair or two pair
3855 LET a=Ø: FOR i=1 TO 5: IF v
(i,2)=2 THEN  LET a=a+1: LET b=i
3856 NEXT i
386Ø IF a=Ø THEN  GO TO 393Ø
387Ø IF a=2 THEN  GO TO 39ØØ
388Ø LET e1=v(b,1): LET disp1=v(
b,2)-1
3895 LET x$="A PAIR OF "+STR$ v(
b,1)+"'s": GO TO 393Ø
39ØØ LET a=Ø: FOR i=1 TO 5
39Ø5 IF v(i,2)=2 AND NOT a THEN
 LET a=i
391Ø IF v(i,2)=2 AND a THEN  LET
 b=i
3915 NEXT i
392Ø LET x$="TWO PAIRS, "+STR$ v
(a,1)+"'s & "+STR$ v(b,1)+"'s"
3925 LET disp1=v(a,2)-1: LET e1=
v(a,1): LET disp2=v(b,2)-1: LET
e2=v(b,1)
3929 REM set total & high/low
markers
393Ø LET total=Ø: LET high=Ø: LE
T low=Ø: FOR i=1 TO 5
394Ø LET total=total+r(i): NEXT
i
395Ø IF total>12 AND total<23 TH
EN  GO TO 3995
3955 IF total>25 THEN  LET high=
3
396Ø IF total>22 AND total<26 TH
EN  LET high=2
3965 IF total<1Ø THEN  LET low=3
397Ø IF total>9 AND total<13 THE
N  LET low=2
3975 IF CODE x$(1)<>32 THEN  GO
TO 3985
3979 REM high or low
398Ø GO SUB 4Ø1Ø: RETURN
3984 REM combination decision
3985 IF play=1 AND go=-1 THEN  G
O TO 3994
3986 PRINT AT 21,Ø;"You now have
 a choice...........": PAUSE 2ØØ
: PRINT AT 21,Ø;"Hi/lo or ";x$(1
 TO 22);"?"
399Ø INPUT "'hl' for high/low or
 'x' "; LINE r$
3991 IF r$<>"hl" AND r$<>"x" THE
N  GO TO 399Ø
3993 IF r$="hl" THEN  GO SUB 4Ø1
Ø
3994 REM run
3995 FOR i=1 TO 4: IF r(i)<>r(i+
1)+1 THEN  GO TO 3998
3996 NEXT i
3997 LET disp1=(3 AND r(1)=6)+(2
 AND r(1)=5): LET e1=7: LET x$="
A "+("HIGH" AND r(1)=6)+("LOW" A
ND r(1)=5)+" RUN"
3998 IF CODE x$(1)=32 THEN  LET
x$="      NOTHING OF ANY VALUE!"
4ØØØ RETURN
4Ø1Ø LET x$=("HIGH OF " AND high
)+("LOW OF " AND low)+STR$ total
4Ø2Ø LET disp1=(high AND high)+(
low AND low): LET disp2=Ø
4Ø3Ø LET e1=(8 AND high)+(9 AND
low): LET e2=Ø
4Ø4Ø RETURN
45ØØ REM win check
451Ø LET a=Ø: LET b=Ø
452Ø FOR i=1 TO 9
453Ø IF f(i)<4 THEN  LET a=a+1
454Ø IF f(i)>1Ø THEN  LET b=b+1
455Ø NEXT i
456Ø IF a>2 OR b>2 THEN  GO TO 4
575
457Ø RETURN
4575 FOR i=1 TO 2Ø
458Ø IF play=2 THEN  PRINT AT 21
,5; FLASH 1; BRIGHT 1; INK 1; PA
PER 6;"PLAYER "+("ONE" AND a>2)+
("TWO" AND b>2)+" HAS WON"
4581 IF play=1 THEN  PRINT AT 21
,5; FLASH 1; BRIGHT 1; INK 1; PA
PER 6;("SPECTRUM HAS WON!!!" AND
 a>2)+("YOU WIN! WELL DONE." AND
 b>2)
4585 BEEP .Ø1,i: NEXT i
```

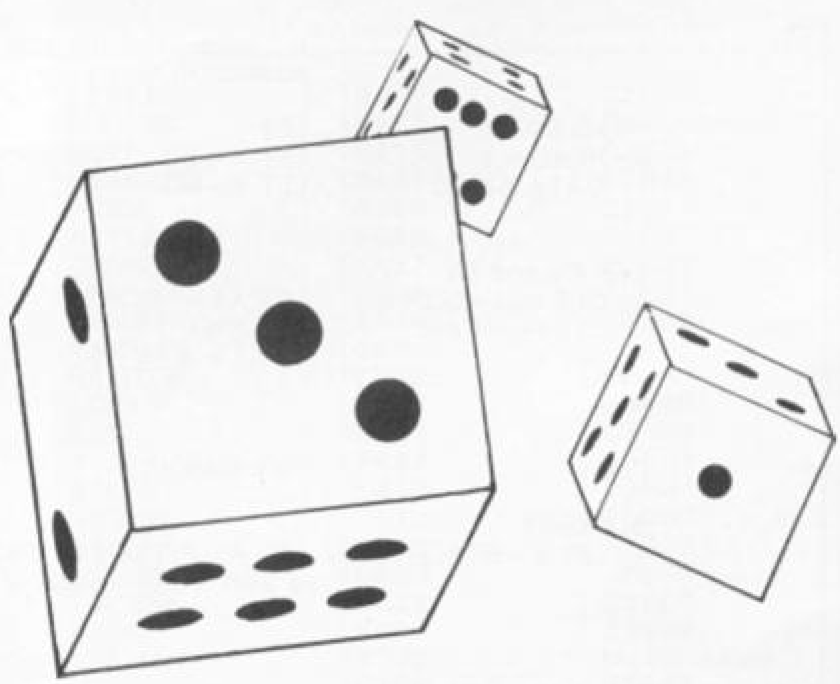
```
4590 LET r$="": INPUT "Another g
ame? ('y' or 'n') "; LINE r$
4600 IF r$="" THEN  GO TO 4590
4610 IF r$="y" THEN  GO TO 4660
4620 LET r$="": INPUT "STOP? ('s
' or 'n') "; LINE r$
4630 IF r$="" THEN  GO TO 4620
4640 IF r$="s" THEN  STOP
4650 GO TO 4590
4660 CLS : PRINT "YOU NOW HAVE T
HE OPTION TO "'''"CHANGE THE GAME
 MODE.."'''"FIRSTLY ENTER ""1"" O
R ""2"" FOR"'''"THE NUMBER OF PLA
YERS THEN (IF"'''"YOU ARE PLAYING
 THE SPECTRUM)"'''"ENTER ""-1"" I
F YOU WISH TO GO"'''"FIRST, OTHER
WISE ENTER ""1"""
4670 INPUT "ONE OR TWO PLAYERS?
";play
4680 LET play=INT play: IF play<
1 OR play>2 THEN  GO TO 4670
4690 IF play=2 THEN  GO TO 60
4700 INPUT """-1"" TO GO FIRST O
R ""1"" ";go
4710 LET go=INT go: IF go=0 OR g
o>1 OR go<-1 THEN  GO TO 4700
4720 GO TO 60
4999 REM set priority marker
5000 DIM p(9): LET a1=0: LET a2=
0
5010 FOR i=1 TO 9: REM any count
ers in red areas?
5020 IF f(i)<4 THEN  LET a1=a1+1
5030 IF f(i)>10 THEN  LET a2=a2+
1
5040 NEXT i
5050 IF a1<>2 OR a2<>2 THEN  GO
TO 5210
5060 LET b1=7
5070 FOR i=1 TO 9
5080 IF f(i)<b1 AND f(i)>3 THEN
 LET b1=f(i): LET b2=i
5090 NEXT i
5100 IF b1=7 THEN  GO TO 5130
5110 IF b2<7 THEN  LET p(b2)=1:
RETURN
5120 LET p(b2)=b2: RETURN
5130 LET b1=14
5140 FOR i=1 TO 6
5150 IF f(i)<b1 AND f(i)>10 THEN
  LET b1=f(i): LET b2=i
5160 NEXT i: IF b1=14 THEN  GO T
O 5180
5170 LET p(b2)=1: RETURN
5180 FOR i=7 TO 9
5190 IF f(i)<b1 AND f(i)>10 THEN
  LET b1=f(i): LET b2=i
5200 NEXT i: LET p(b2)=b2: RETUR
N
5210 IF a1<>2 THEN  GO TO 5280
5220 LET b1=14
5230 FOR i=1 TO 9
5240 IF f(i)<b1 AND f(i)>3 THEN
 LET b1=f(i): LET b2=i
5250>NEXT i
5260 IF b2>=7 THEN  LET p(b2)=b2
: RETURN
5270 LET p(b2)=1: RETURN
5280 IF a2<>2 THEN  GO TO 5380
5290 LET a2=0: FOR i=7 TO 9
5300 IF f(i)>10 THEN  LET a2=a2+
1
5310 NEXT i: IF a2<2 THEN  GO TO
 5350
5320 FOR i=7 TO 9
5330 IF f(i)>10 THEN  LET p(i)=i
5340 NEXT i: RETURN
5350 LET b1=14: FOR i=1 TO 6
5360 IF f(i)>10 AND f(i)<b1 THEN
  LET b1=f(i): LET b2=i
5370 NEXT i: LET p(b2)=1: RETURN

5380 FOR i=1 TO 9
5390 IF f(i)=1 THEN  LET p(i)=3
5400 IF f(i)=2 OR f(i)=3 THEN  L
ET p(i)=2
5410 NEXT i: RETURN
5499 REM check prioriy=1
5500 LET a=0: LET m=0: FOR i=1 T
O 6
5510 IF p(i)=1 THEN  LET a=i
5520 NEXT i: IF a=0 THEN  GO TO
5570
5530 FOR i=1 TO 5
5540 IF r(i)<>a THEN  GO SUB 621
0
5550 NEXT i: IF m=0 THEN  GO TO
310
5560 RETURN
5570 IF p(7)>1 THEN  GO TO 5640:
 REM run not worthwhile
5580 IF e1=7 THEN  GO TO 310
5590 IF e1=0 AND e2=0 THEN  LET
m=1: LET t(1)=5: RETURN
5600 IF p(7)<>7 THEN  GO TO 5640
: REM run n/w
5610 FOR i=1 TO 4
5620 IF r(i)=e1 THEN  LET m=1: L
ET t(1)=i: RETURN
5630 NEXT i
5640 IF p(8)<>8 OR total<20 THEN
  GO TO 5720: REM high n/w
5650 IF total>23 THEN  GO TO 569
0
5660 FOR i=3 TO 5
5670 IF r(i)<4 THEN  GO SUB 6210
5680 RETURN
5690 FOR i=4 TO 5
```

```
5700 IF r(i)<3 THEN  GO SUB 6210
5710 RETURN
5720 IF p(9)<>9 OR total>15 THEN
  GO TO 5800: REM low n/w
5730 IF total<12 THEN  GO TO 577
0
5740 FOR i=1 TO 3
5750 IF r(i)>3 THEN  GO SUB 6210
5760 NEXT i: RETURN
5770 FOR i=1 TO 2
5780 IF r(i)>2 THEN  GO SUB 6210
5790 RETURN
5800 IF displ=1 AND disp2=1 THEN
  GO TO 5860
5810 IF displ<>1 THEN  GO TO 598
0: REM not pair
5820 FOR i=1 TO 5
5830 IF r(i)<>e1 AND p(e1)=0 THE
N  GO SUB 6210
5840 IF p(e1)>1 THEN  LET m=4: I
F i>1 THEN  LET t(i)=i
5850 NEXT i: RETURN
5860 IF p(e1)>1 AND p(e2)>1 THEN
  GO TO 5910: REM 2 pair NG
5870 IF p(e1)=0 AND p(e2)=0 THEN
  GO TO 5940: REM 2 pair OK,re-r
oll odd
5879 REM 2 pair, re-roll 1 pair
& odd
5880 FOR i=1 TO 5
5890 IF r(i)<>e2 AND p(e2)=0 OR
r(i)<>e1 AND p(e1)=0 THEN  GO SU
B 6210
5900 NEXT i: RETURN
5910 FOR i=1 TO 5
5920 IF r(i)=e1 OR r(i)=e2 THEN
 GO SUB 6210
5930 NEXT i: RETURN
5940 FOR i=1 TO 5
5950 IF r(i)<>e1 AND r(i)<>e2 TH
EN  GO SUB 6210
5970 NEXT i: RETURN
5980 IF displ<>2 AND disp2<>2 TH
EN  GO TO 6110: REM not three
5990 IF displ=1 OR disp2=1 THEN
 GO TO 6050
6000 FOR i=1 TO 5
6005 IF e1=0 THEN  GO TO 6025
6010 IF displ=2 AND f(e1)>5 AND
r(i)<>e1 THEN  GO SUB 6210
6015 IF p(e1)=3 AND r(i)=e1 THEN
  GO SUB 6210
6020 IF f(e1)<6 AND p(e1)<3 AND
r(i)<>e1 THEN  LET m=1: LET t(1)
=i
6025 IF e2=0 THEN  GO TO 6045
6030 IF disp2=2 AND f(e2)>5 AND
r(i)<>e2 THEN  GO SUB 6210
6035 IF p(e2)=3 AND r(i)=e2 THEN
  GO SUB 6210
6040 IF f(e2)<6 AND p(e2)<3 AND
r(i)<>e2 THEN  LET m=1: LET t(1)
=i
6045 NEXT i: RETURN
6049 REM full house
6050 IF e1=0 AND e2=0 THEN  GO T
O 310
6060 FOR i=1 TO 5
6070 IF p(e1)>1 AND p(e2)>1 THEN
  GO SUB 6210
6080 IF p(e1)>1 AND p(e2)=0 AND
r(i)<>e2 THEN  GO SUB 6210
6090 IF p(e1)=0 AND p(e2)>1 AND
r(i)<>e1 THEN  GO SUB 6210
6100 NEXT i: RETURN
6110 IF displ<>3 AND disp2<>3 OR
 e1>6 THEN  GO TO 6150: REM not
four
6120 FOR i=1 TO 5
6130 IF r(i)<>e1 AND displ=3 OR
r(i)<>e2 AND disp2=3 THEN  GO SU
B 6210
6140 NEXT i: RETURN
6150 IF high=3 OR low=3 OR displ
=4 OR e1=7 AND p(7)=0 THEN  GO T
O 310: REM no re-roll
6160 IF high=2 AND p(8)=0 THEN
LET m=1: LET t(1)=5: RETURN
6170 IF low=2 AND p(9)=0 THEN  L
ET m=1: LET t(1)=1: RETURN
6180 LET m=5: FOR i=1 TO 5
6190 LET t(i)=i: NEXT i: RETURN
6210 LET m=m+1: LET t(m)=i
6220 RETURN
6300 IF NOT high AND NOT low THE
N  RETURN
6310 IF f(8)<4 AND high OR f(9)<
4 AND low THEN  RETURN
6320 IF displ=2 AND disp2=1 AND
(f(8)-high)>3 AND high THEN  RET
URN
6321 IF displ=2 AND disp2=1 AND
(f(9)-low)>3 AND low THEN  RETUR
N
6322 IF displ=1 AND disp2=2 AND
(f(8)-high)>3 AND high THEN  RET
URN
6323 IF displ=1 AND disp2=2 AND
(f(9)-low)>3 AND low THEN  RETUR
N
6330 IF displ>high AND high OR d
ispl>low AND low THEN  RETURN
6340 IF (f(e1)-displ)<4 THEN  RE
TURN
6344 IF e2=0 THEN  GO TO 6350
6345 IF (f(e2)-disp2)<4 THEN  RE
TURN
6350 IF f(e1)>10 AND f(8)<10 AND
```

```
 high THEN  RETURN
6354 IF e2=Ø THEN  GO TO 636Ø
6355 IF f(e2)>1Ø AND f(8)<1Ø AND
 high THEN  RETURN
636Ø IF f(e1)>1Ø AND f(9)<1Ø AND
 low THEN  RETURN
6364 IF e2=Ø THEN  GO TO 637Ø
6365 IF f(e2)>1Ø AND f(9)<1Ø AND
 low THEN  RETURN
637Ø GO SUB 4Ø1Ø: RETURN
8999 REM graphics
9ØØØ FOR i=Ø TO 17: PRINT  PAPER
 6;AT i,14;"   ": NEXT i
9ØØ5 PRINT  PAPER 6;AT Ø,15;" "
;AT 1,15;" ";AT 2,15;" ";AT 3,
15;" ";AT 4,15;" ";AT 5,15;"
";AT 6,15;" ";AT 7,15;" ";AT 8
,15;" ";AT 9,15;" ";AT 1Ø,15;"
 ";AT 11,15;" ";AT 12,15;" ";
AT 13,15;" ";AT 14,15;" ";AT 1
5,15;" ";AT 16,15;" ";AT 17,15
;" "
9Ø1Ø FOR i=Ø TO 17: PRINT  PAPER
 2;AT i,2;z$;AT i,23;z$: NEXT i
9Ø2Ø FOR i=Ø TO 17: PRINT  PAPER
 4;AT i,8;z$;AT i,17;z$: NEXT i
9Ø4Ø PLOT 15,31: FOR i=1 TO 4: D
RAW 216,Ø: DRAW Ø,16: DRAW -216,
Ø: DRAW Ø,16: NEXT i: DRAW 216,Ø
: DRAW Ø,16: DRAW -216,Ø
9Ø5Ø FOR i=2 TO 14 STEP 2: PLOT
i*8-1,175: DRAW Ø,-143: NEXT i:
FOR i=17 TO 29 STEP 2: PLOT i*8-
1,175: DRAW Ø,-143: NEXT i
9Ø55 IF play=1 THEN  GO TO 9Ø7Ø
9Ø6Ø PRINT  INK 1;AT 4,Ø;"P";AT
5,Ø;"L";AT 6,Ø;"A";AT 7,Ø;"Y";AT
 8,Ø;"E";AT 9,Ø;"R";AT 11,Ø;"O";
AT 12,Ø;"N";AT 13,Ø;"E"
9Ø65 PRINT  INK 2;AT 4,3Ø;"P";AT
 5,3Ø;"L";AT 6,3Ø;"A";AT 7,3Ø;"Y
";AT 8,3Ø;"E";AT 9,3Ø;"R";AT 11,
3Ø;"T";AT 12,3Ø;"W";AT 13,3Ø;"O"
: GO TO 9Ø8Ø
9Ø7Ø PRINT  INK 1;AT 4,Ø;"S";AT
5,Ø;"P";AT 6,Ø;"E";AT 7,Ø;"C";AT
 8,Ø;"T";AT 9,Ø;"R";AT 1Ø,Ø;"U";
AT 11,Ø;"M"
9Ø75 PRINT  INK 2;AT 4,3Ø;"Y";AT
 5,3Ø;"O";AT 6,3Ø;"U";AT 7,3Ø;"R
";AT 8,3Ø;"S";AT 9,3Ø;"E";AT 1Ø,
3Ø;"L";AT 11,3Ø;"F"
9Ø8Ø IF go=1 THEN  PRINT AT 15,Ø
; INK 7; PAPER Ø; FLASH 1;"X";AT
 15,3Ø; PAPER 7;" "
9Ø85 IF go=-1 THEN  PRINT AT 15,
Ø; PAPER 7;" ";AT 15,3Ø; INK 7;
PAPER Ø; FLASH 1;"X"
9Ø9Ø RETURN
91ØØ REM instructions
911Ø BORDER 1: INK 6: PAPER 1: P
RINT : CLS
912Ø PRINT "THE PURPOSE OF THIS
GAME IS TO"''"MANOEUVRE THREE CO
UNTERS INTO"''"THE RED AREA AT Y
OUR END OF THE"''"BOARD. YOUR OP
PONENT WILL, IN"''"TURN, DO LIKE
WISE. THERE ARE 9"''
913Ø PRINT "COUNTERS, INITIALLY
PLACED DOWN"''"THE CENTRE OF THE
 BOARD, ONE IN"''"EACH OF LANES
1-6, R, H & L. YOU"''"WILL NORMA
LLY BE ABLE TO MOVE 1"''"OR 2 CO
UNTERS ON EACH TURN. YOU"''"DO T
HIS BY THROWING FIVE DICE."
914Ø GO SUB 93ØØ
915Ø PRINT "AFTER THE FIRST ROLL
 OF THE DICE"''"YOU WILL BE ABLE
 TO RE-ROLL AS"''"MANY DICE AS Y
OU WISH TWICE MORE"''"-YOU CAN R
E-ROLL A DIE ON YOUR"''"SECOND R
E-ROLL THAT YOU HAD KEPT"''
916Ø PRINT "ON YOUR FIRST RE-ROL
L. YOU WILL"''"BE AIMING FOR COM
BINATIONS THAT"''"WILL MOVE THE
COUNTERS TO YOUR"''"ADVANTAGE- P
OSSIBLY GETTING "''"COUNTER(S) I
NTO YOUR RED AREA OR"''"OUT OF Y
OUR OPPONENTS RED AREA."
917Ø GO SUB 93ØØ
918Ø PRINT "COMBINATIONS THAT WI
LL MOVE"''"COUNTERS ARE:"''"  TW
O OR MORE OF THE SAME DIE"''"  (M
OVES LANE NUMBER OF DICE"''"  VAL
UE)"''"  A RUN OF ALL FIVE DICE"
''"  (MOVES 'R' LANE)"
919Ø PRINT ''"  A HIGH SCORE (MOV
ES 'H' LANE)"''"  A LOW SCORE (M
OVES 'L' LANE)"''"PRESS ANY KEY
TO SEE HOW MANY"''"SQUARES THE C
OUNTERS CAN MOVE"
92ØØ PAUSE Ø: BEEP .25,3: BEEP .
15,Ø: CLS
921Ø PRINT TAB 17;"A PAIR";TAB 2
6;"1"''TAB 12;"3 OF A KIND";TAB
26;"2";''TAB 9;"FOUR OF A KIND";
TAB 26;"3"''TAB 9;"FIVE OF A KIN
D";TAB 26;"4"''TAB 9;"HIGH RUN (
2-6)";TAB 26;"3"''
922Ø PRINT TAB 1Ø;"LOW RUN (1-5)
";TAB 26;"2"''TAB 8;"HIGH SCORE(
>25)";TAB 26;"3"''TAB 6;"HIGH SC
ORE(23-25)";TAB 26;"2"''TAB 8;"L
OW SCORE (<1Ø)";TAB 26;"3"''TAB
6;"LOW SCORE (1Ø-12)";TAB 26;"2"
''"NOTE THAT 2 COUNTERS CAN BE"'
"MOVED WITH 2 PAIRS OR FULL HOUS
E"
```

```
9230 GO SUB 9300
9240 PRINT 'TAB 14;"NOTES";AT 1,
14; OVER 1;"______"'''"1) YOU CANN
OT COMBINE MOVES IN"'"  THE HIG
H & LOW LANES WITH"'"   MOVES IN
 THE 1-6 LANES."'''"2) A COUNTER
CANNOT GO BEYOND"'"   THE OUTER
RED RANK- ANY"'
9245 PRINT "   SURPLUS MOVES ARE
 WASTED"'''"3) A PLAYER'S TURN IS
 SHOWN BY "; FLASH 1; INK 7; PAP
ER 0;"X"; FLASH 0; INK 6; PAPER
1''
9250 PRINT "4) DICE NOS. ARE SHO
WN IN BLACK"'"    ON GREEN- E.G.
"; INK 0; PAPER 4;"5": GO SUB 93
00
9255 CLS : PRINT "WHEN THE BOARD
 IS SET UP "'''"THE COUNTERS ARE
INITIALLY"'''"SUPERIMPOSED OVER T
HE CENTRAL"'''"LANE MARKINGS, BUT
 ONCE ONE IS"'''"MOVED IT APPEARS
 AS: "''TAB 15; INK 0; PAPER 6;"
\/"; PAPER 1'TAB 15; PAPER 6;"/\
"
9260 PRINT "_____________________
______________"''''"IF YOU WISH TO
 SEE THESE"'''"INSTRUCTIONS AGAIN
 PRESS ""i"""'''"OTHERWISE PRESS
ANY OTHER KEY": PAUSE 0: IF INKE
Y$="i" THEN  GO TO 9110
9270 BORDER 1: PAPER 1: INK 6: C
LS : PRINT "IF YOU WISH TO PLAY
THE SPECTRUM"'''"ENTER ""1"" OTHE
RWISE DECIDE NOW"'''"WHO IS TO GO
 FIRST AND ENTER ""2"""''''"(BLOW
ON THE KEYBOARD FOR LUCK)"
9271 INPUT "ENTER ""1"" OR ""2""
 ";play
9272 LET play=INT play: IF play>
2 OR play<1 THEN  GO TO 9271
9275 IF PLAY=2 THEN  GO TO 9290
9280 CLS : PRINT "PLEASE NOTE TH
AT WHEN THE "'''"SPECTRUM HAS DEC
IDED WHICH"'''"DICE TO RE-ROLL IT
 WILL "'''"RE-ARRANGE THE DICE IN
 NUMERICAL"'''"ORDER IMMEDIATELY
BEFORE "'''"STARTING TO RE-ROLL T
HEM."'''
9285 PRINT "IF YOU WISH TO GO FI
RST ENTER"'''"""-1"" OTHERWISE EN
TER ""1"""
9286 INPUT "ENTER ""1"" OR ""-1"
" ";go
9287 LET go=INT go: IF go=0 OR g
o>1 OR go<-1 THEN  GO TO 9286
9290 BEEP .25,3: BEEP .15,0: BEE
P .15,0: BEEP .25,3: CLS : RETUR
N
9300 PRINT #1;"PRESS ANY KEY TO
CONTINUE": PAUSE 0: BEEP .25,3:
BEEP .15,0: CLS : RETURN
9900 FOR i=0 TO (10*8-1)
9901 READ a
9902 POKE USR "a"+i,a
9903 NEXT i
9904 RETURN
9905 DATA 0,8,24,56,120,88,88,24
,24,24,24,24,24,126,126,0: REM A
&B=1
9910 DATA 0,0,60,126,70,2,6,12,1
2,24,24,48,48,126,126,0: REM C&D
=2
9915 DATA 0,126,126,6,12,24,48,9
6,124,126,6,6,102,124,120,0: REM
 E&F=3
9920 DATA 0,6,14,30,54,102,102,1
02,102,127,127,6,6,6,6,0: REM G&
H=4
9925 DATA 0,126,126,96,96,96,126
,126,6,6,6,12,24,112,96,0: REM I
&J=5
9930 DATA 0,6,12,24,24,48,48,120
,108,108,102,102,54,60,24,0: REM
 K&L=6
9935 DATA 0,56,124,102,102,108,1
08,120,112,120,108,108,102,102,1
02,0: REM M&N=R
9940 DATA 0,102,102,102,102,102,
102,126,126,102,102,102,102,102,
102,0: REM O&P=H
9945 DATA 0,96,96,96,96,96,96,96
,96,96,96,96,96,126,126,0: REM Q
&R=L
9950 DATA 20,28,68,28,116,28,164
,28,212,28: REM dice plot co-ord
s
```



Conversion tips

A guide to ZX81/Spectrum program conversions from David Nowotnik.

The versions of BASIC offered by the two ZX computers are so similar that many programs for one can be used by the other. The ZX81 has only two commands which are not present on the Spectrum, SCROLL and UNPLOT, and these should cause you few problems when converting ZX81 programs to the Spectrum (see Table 1).

There are quite a lot of commands and functions on the Spectrum which are not available on the ZX81. A list of these appears in Table 4. The stars indicate those commands and functions for which there is no simple translation to ZX81 BASIC. Those for colour and sound can be ommitted; but you will have to find some alternative for the high resolution and file I/O commands.

The command PLOT appears on both computers, but the effect is quite different, so beware! Another tip: PEEK and POKE should be used with caution. In conversion, addresses will almost certainly have to be changed. Some of those changes appear in the tables. A command such as POKE USR "a".... on the Spectrum indicates User Defined Graphics; ZX81 users don't have this facility, so you'll have to omit this and use a standard character instead.

ZX81	Spectrum	Comments
SCROLL	RANDOMISE USR 3582 or LET t=USR 3582	If the program uses random numbers, they could become rather predictable with the first option. If so, use the second, using a variable (in this case t) which is otherwise not used.
PLOT Y,X	PRINT AT 21−Y/2,X/2;	Print the appropriate quarter square graphics character.
UNPLOT Y,X	PRINT AT 21−Y/2,X/2;	Print a space, or the appropriate quarter square graphics character.

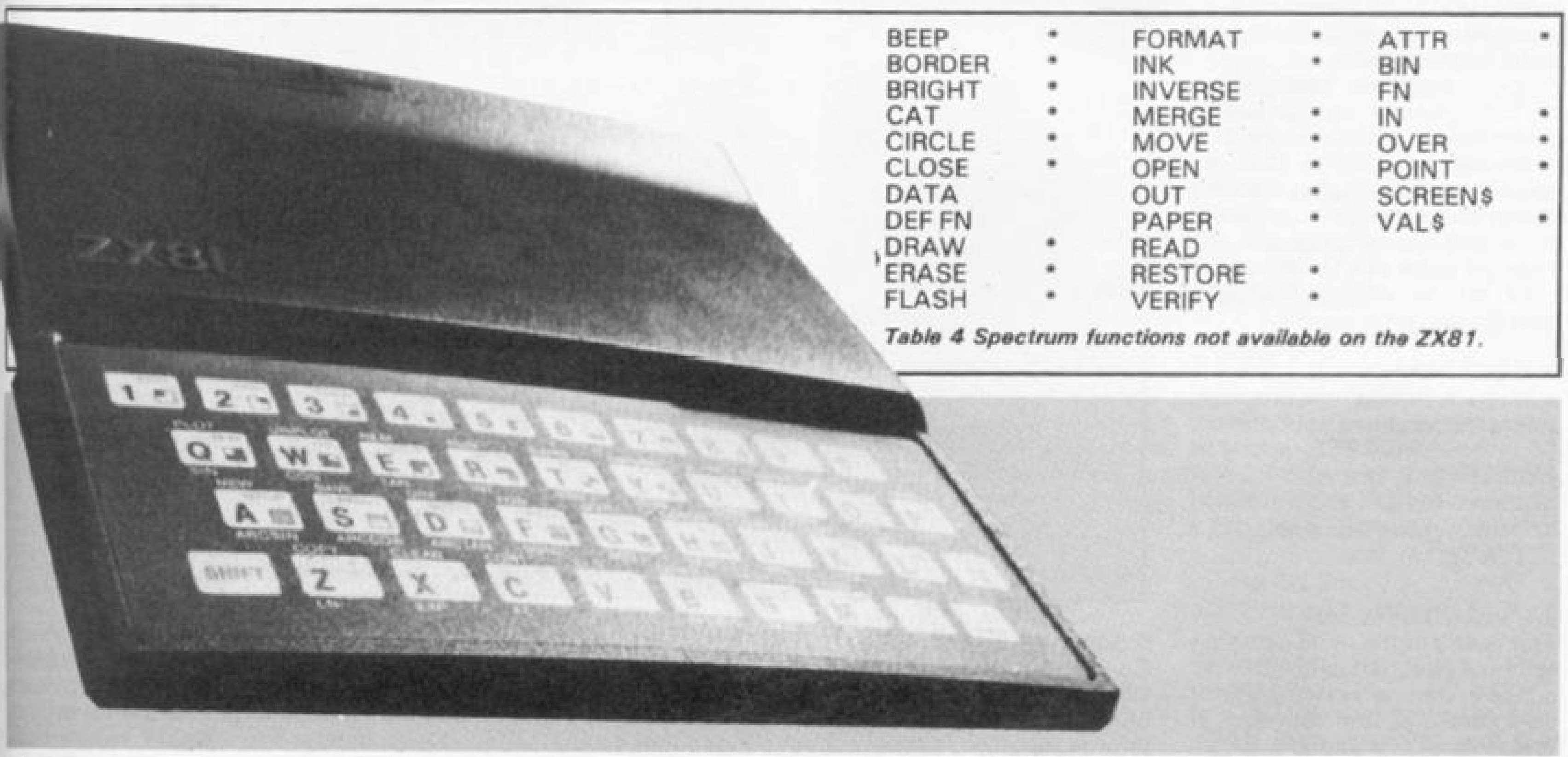
Table 1 ZX81 to Spectrum conversions.

Spectrum	ZX81	Comments
BIN eg LET y=BIN 10010101	LET y=(decimal no.) Conversion to decimal: 10010101=149 128 64 32 16 8 4 2 1 Add these numbers together when a 1 appears at the appropriate position in binary.	BIN allows the representation of a number in binary. On the ZX81 use the decimal equivalent, but beware; BIN is often used with User Defined Graphics, which are not available on the ZX81.
READ/DATA eg READ x,y DATA 50,60	LET LET X=50 LET Y=60	READ and DATA are used to store a lot of information in a program. Use LET instead.
DEF FN and FN eg DEF a(x)=SQR x LET t=FN a(i)	LET X$="SQR X" LET X=I LET T= VAL X$	The defined function can appear in a string. Use the keyword for built-in functions (eg SQR). The equivalent of FN may need 2 lines, as shown.
PLOT	no equivalent	
SCREEN$ eg LET a=SCREEN$ x,y	LET A=PEEK(PEEK 16396 +256*PEEK 16397+1+Y+33*X)	Used in interactive games to detect characters in the display file. Note — this formula only works when a RAM pack is fitted.

Table 2 Spectrum to ZX81 conversions.

ZX81	Spectrum	Comments
1 FRAMES POKE 16436,255 POKE 16437,255 LET T=(65535−PEEK 16436−256*PEEK 16437) /50	POKE 23672,0:POKE 23673,0 LET t=(PEEK 23672+256* PEEK 23673)/50 For times greater than 10 minutes, you can use byte 23674 as well.	Both computers have a counter which accurately varies by 50 every second. In the example, use the first line to start the 'clock'. The variable T will have the time in seconds after the start. The counter can only be used for 10 minutes.
2 Line number zero POKE 16510,0	POKE 23756,0 (As the start of BASIC can move, eg with microdrives) use with caution.	Converts the first line of a program to line number zero. which cannot be edited, and so is protected.
3 RAMTOP POKE 16388,X−256*INT (X/256) POKE 16389, INT (X/256)	CLEAR x	Creates a safe area at the top of RAM starting at address x, for storing data, machine code etc.

Table 3 General interconversion hints.



BEEP	*	FORMAT	*	ATTR	*
BORDER	*	INK	*	BIN	
BRIGHT	*	INVERSE		FN	
CAT	*	MERGE	*	IN	*
CIRCLE	*	MOVE	*	OVER	*
CLOSE	*	OPEN	*	POINT	*
DATA		OUT	*	SCREEN$	
DEF FN		PAPER	*	VAL$	*
DRAW	*	READ			
ERASE	*	RESTORE	*		
FLASH	*	VERIFY	*		

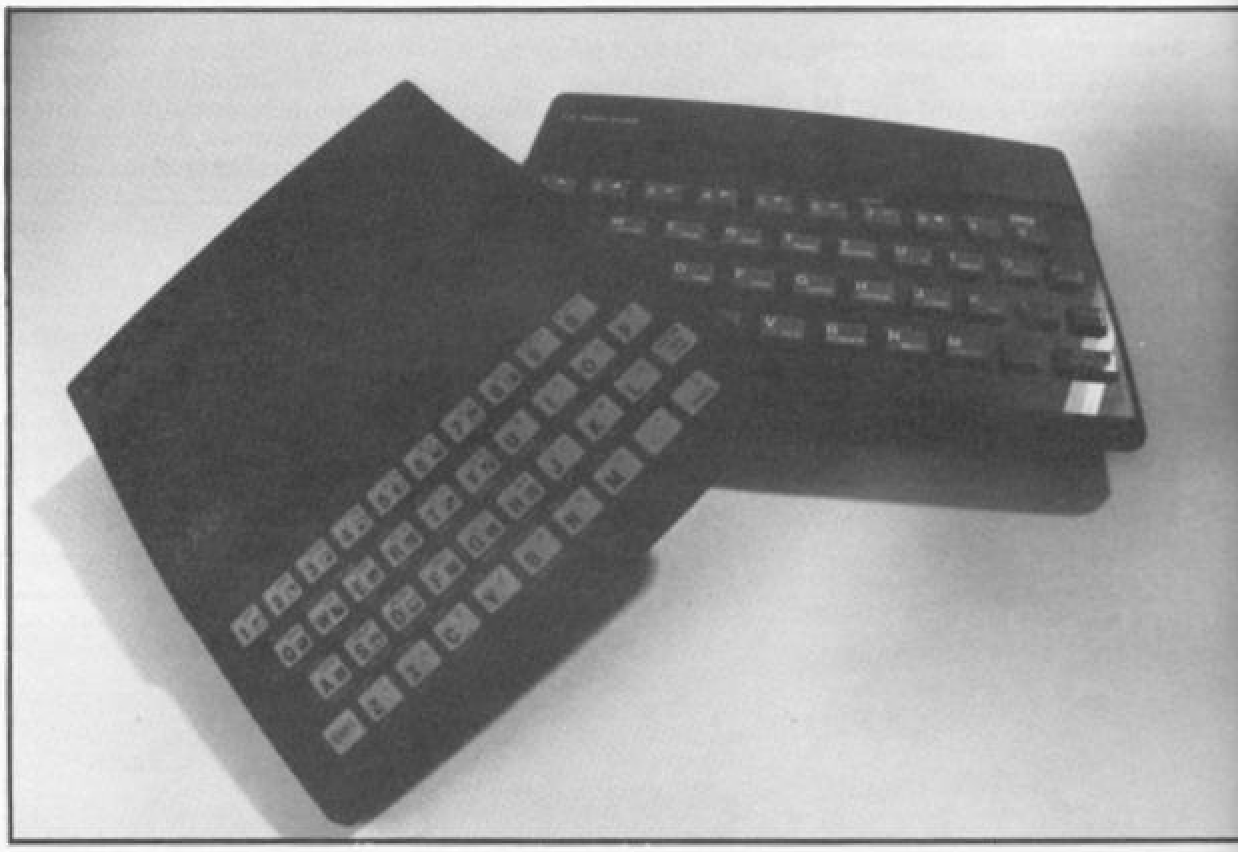
Table 4 Spectrum functions not available on the ZX81.

System Variables Conversion Table.

Variable	ZX81/ T/S1000	Spectrum/ TS2068
BREG	16414	23655
CDFLAG	16443	No Equivalent
CH ADD	16406	23645
COORDS	16438	23677
COORDS (Byte 2)	16439	23678
DEST	16402	23629
DF CC	16398	23684
D FILE	16396	No Equivalent
DF SZ	16418	23659
E LINE	16404	23641
ERR NR	16384	23610
E PPC	16294	23625
ERR SP	16386	23613
FLAGS	16385	23611
FLAGX	16429	23665
FRAMES	16436	23672
LAST K	16421	23560
MARGIN	16424	No Equivalent
MEM	16415	23656
MEMBOTT	16477	23698
MODE	16390	23617
NXTLIN	16425	23637
OLDPCC	16427	23662
PPC	16391	23621
PRBUFF	16444	23296
PR CC	16440	23680
RAMTOP	16388	23730
SEED	16434	23670
S PSN	16441	23688
S POSN (Byte 2)	16442	23689
STKBOT	16410	23651
STKEND	16412	23653
S TOP	16419	23660
STRLEN	16430	23666
T-ADDR	16432	23668
VARS	16400	23627
VERSN	16393	No Equivalent
X PTR	16408	23647

De-bugger

Getting a program typed in is often only the start of your problems. Ed to the rescue.



Typing in a program is a useful exercise. Apart from the patience required, techniques learned and the end program to be used, probably the most educational part of it is tracking down the bugs introduced by yourself or occasionally by our publication system.

In debugging you gain a much deeper insight and understanding on how the program actually works than by merely typing it in, but tracking down these errors is an art in itself and needs some skill. So here are some tips to help you in your efforts when faced with that cryptic error report!

1 NEXT without FOR
Look back through the program, either the loop has not been set up — no related FOR 'letter' = No1 TO No2 line, or the letter has been re-used as an ordinary variable within the loop with a LET 'letter' = No.

2 Variable not found
This is one of the most common errors. Again, the problem may not lie in the line where the error was detected and reported. If there is only one variable, which may be one or more letters or a string ($) variable, then that is the problem. There may be more than one variable in the line section reported and you will have to identify the offending one. In a line PRINT AT Y,X;A$ the culprit could be Y or X or A$. To find out which of them is causing the problem (it may be more than one) type in turn as a direct command:

```
PRINT Y Enter/Newline
PRINT X Enter/Newline
PRINT A$ Enter/Newline
```

Note which produces the error report. Now look back through the program printout for the line which sets it up — usually a LET or FOR command. Did you leave it out? Does the program get there or has a GOTO/GOSUB been wrongly addressed?

3 Subscript wrong
Connected with DIM A(No) or DIM A$(No). If the number in the brackets on the line where the error is reported is greater than the one in the original DIM statement, is not an integer or is less than 1, then this report is generated. If the subscript — number in brackets — is a number then check and change, however, if it is a variable then follow the procedure for tracing variables. It has probably exceeded the limits, look for lines with the variable being altered with + − * / : if necessary add limiting code. For example:

```
IF X >10 THEN LET X = 10
```

4 Out of memory
As well as for programs which are too big, it may happen if the previous program set RAMtop. Before despairing, enter CLEAR USR "a"-1 on the Spectrum: on the ZX81 SAVE the program, turn the machine off and on, then reload the program.

7 RETURN without GOSUB
Somehow the computer has reached a RETURN command other than via a GOSUB instruction. Check a GOTO hasn't been entered in place of a GOSUB. Check for a missing GOSUB.

B Integer out of range
An integer (whole number) either as a number of variable is too big or small and you are attempting to do something like PRINT AT 0,33 — not allowed! Check any variables involved as per report 2 and trace it back through the program looking for adjustments to it by + − * / : Add limiting code if needed — see report 3

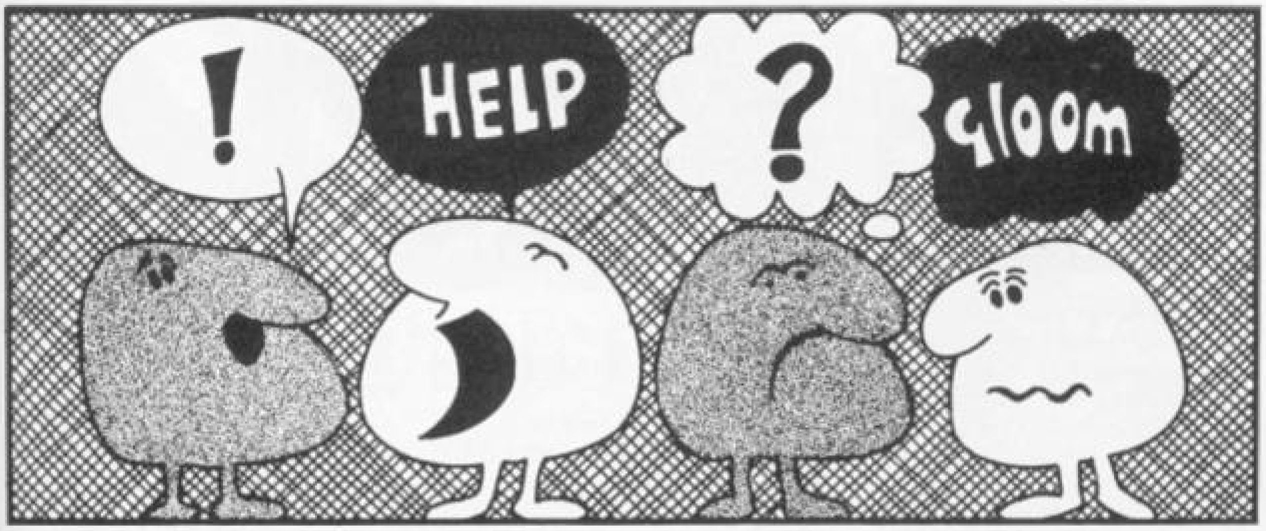
E Out of DATA
A Spectrum problem. Check the number of DATA items match the number of READs; usually one (or more) has been missed out. Attempting to reread a DATA list without first using a RESTORE command will cause this and it can happen on an auto start program (saved with a LINE number). Good programming usually RESTOREs to the correct line number before using READ.

I FOR without NEXT
See report 1 but this time the NEXT is missing!

Note that the letters I have used for examples could by ANY letters not just A$,X,Y etc and depend on the particular choice of the programmer.

This is by no means a comprehensive list but I have tried to cover many of the most common error reports. Personally, I get almost as much satisfaction from debugging as I do from programming I do assure you, however, that there is absolutely no truth in the rumour that we deliberately inject bugs into our listings in order to introduce you to the dubious delights of debugging!

Problem Page



Floating Points

Dear David,
I have just written a very long program on my 48K Spectrum, and one thing is causing me a problem. There seems to be a bug in the system. As an example, the following lines work alright:

```
LET fc=5 *6
PRINT fc          (=30)
PRINT INT fc      (=30)
```

but the following didn't:

```
LET fc=.5 *6 *10
PRINT fc          (=30)
PRINT INT fc      (=29)
```

Is this a bug on my computer? I am at my wits' end trying to solve this problem, as my program uses INT often. Can you help?

(Mrs) Dane Kurth,
Busswil, Switzerland

Dear Dane,
The problem is not a bug in your computer, as I get the same on my Spectrum. It has to do with the complicated way floating point arithmetic is handled, and, in reality, it is a 'bug' — after all, the answer is wrong. Elsewhere in your letter, you explain that you round numbers to two decimal spaces. Therefore, to overcome this bug, add a very small number of your variable 'fc' (for example 0.0005) when you take the INT of fc instead of INT fc, use INT (fc+.0005). This will correct the 'bug' in the above example, and similar cases without causing the mathematics to be incorrect.

Oh, Brother!

Dear David,
I am having problems getting my newly-acquired Brother HR-5 printer to work with my Spectrum/ZX Interface 1 system. What can I do to make this system work?

Gary Taylor,
Sheffield

Dear Gary,
Another correspondent provided a solution to this problem, so I can pass on the information supplied to me.

The links between the RS232 connector on the ZX Interface and printer should be as follows:

ZX Interface	*HR-5*
2	2
3	3
4	20
5	5
7	7

In addition, the 4,6 and 8 wires on the Brother connector should be joined together. The HR-5 should be set to 8-bit communication, and the Spectrum baud rate set to 300.

Enter

Dear David,
I have seen on a larger computers the facility to enter data without the need for 'ENTER' to be pressed. The computer appears to recognise when a field has been filled, then processes the information without waiting for ENTER. Can the Spectrum do this?

Steve Stewart,
Southport, Lancs

Dear Steve,
The simple answer is yes, although you won't be able to use the INPUT command to do this. Instead, a separate subroutine has to be written to handle this problem. The short piece of code, below is a simple example. It uses INKEY$ to respond to keypresses; once four characters have been entered (a 'full' field, in this case), the variable z$ is returned automatically to be 'processed'. As a simple example, you have no option to delete characters, but I hope that this demontrates the point. It's written to work on the ZX81 as well as the Spectrum.

```
100 LET Z$=""
110 FOR I=1 TO 4
120 LET X$=INKEY$
130 IF X$="" THEN GOTO 130
140 LET Z$=Z$+X$
150 PRINT X$;
160 IF INKEY$=X$ THEN GOTO 160
170 NEXT I
180 RETURN
```

Use the RETURN for a subroutine only.

SLOGO

Dear David,
As I am interested in drawing, your SLOGO program (June-July, 1984) seemed an excellent addition to the plans and elevations which I can produce using PLOT and DRAW.

There are a number of things I'm not sure how to do:

1. Erase a line drawn in error
2. Produce curves or circles
3. Colour in a shape.

Mr A. E. Westerman
West Wickham, Kent

Dear Mr Westerman,
To erase a line, change the INK colour to be the same as PAPER, and re-draw the line.

The CIRCLE command is the simplest way to draw a circle, but you could also use a large REPEAT loop, in which the 'turtle' is moved forward a small amount, then turned a small amount, repeatedly until it gets back to where it started; this is also the way you'd produce a curve, except you wouldn't turn full circle.

The full implementation of LOGO will allow shapes to be filled with a colour. With SLOGO, you'll have to painstakingly move the turtle within the shape, drawing in the INK colour you want, until the shape is filled.

May I extend my thanks to you, Mr Westerman, and all the other readers who have written in with complimentary remarks about SLOGO.

NEWLINE

Dear David,
I am enjoying your machine code series very much. One thing which confuses me is the need for a invisible NEWLINE character on the end of each row of the display file of the ZX81. Can you explain this please?

Peter Robinson,
Hastings, East Sussex

Dear Peter,
When the ZX81 first appeared on the scene, there was no 16K RAM pack available, and users had to make do with the miserable 1K fitted inside the machine. The full display file of 32×24 characters would consume more than half of this, so the designers devised a way of 'shrinking' the display file when all of it was not in use. To tell the computer when the end of a row of characters had been reached (whether the row contained 0, 10, or 32 characters), the NEWLINE character appears at the end of each row. So, if no characters appear in one particular row, two NEWLINE characters appear together, saving 31 bytes compared with the 'full' display file.

The ZX81 automatically detects when it has more than 3.75K of RAM, at which point it will always create a 'full' display file of 33 (including NEWLINE) by 24 characters.



L.I.S.T. Group

Dear ZX Computing
The LIST GROUP has been formed to help keep the spirit of the Sinclair-Timex "people's" computer alive. At this point, we're getting organized; officers have been elected and a monthly newsletter started. A Charter is yet to be written, but "meetings" are held once per month, usually in members' homes.

Despite the lack of a written charter the general goals of our group include:

1) Exchange of information, ideas and knowledge on and about TS computers.
2) Hardware and Software demonstrating and perhaps even exchange.
3) Community service to increase computer literacy.
4) Perhaps some advantage to members through the exercise of a group buying power.

Right now we have about 60 members and a modest budget. A circulating tape library has begun, and we have generated a pretty substantial newsletter. Membership/subscription fees are $9.95 a year.

Hope to hear from you soon.

Paul Donnelly
Long Island Sinclair Timex Group
P.O. Box 438
Centreport, N.Y. 11721-438
U.S.A.

Betadisc Club

Dear ZX Computing,
Because of the enormous interest shown by the owners of the Technology Research Beta-Disc, a small group of us here in Denmark have decided to form an international club.

Members will get four newsletters a year, and an updated list of club members. All the newsletters will be tape-based, and membership will cost £8.00 a year.

The Beta-disc has a lot of potential, and a lot of people don't know how to make the best use of it. How do you get a program onto diskette when the memory is full, how can you halve loading times, change the interface from single to double density? Problems such asthese can be solved by joining our club.

Beta-Disc Club
Per Henneberg Kristensen
Norresobakken III
8800 Viborg
Denmark
Tel: 009 456 61 29 68

Norway User Group

Dear ZX Computing
We hereby send you our address and some information, and hope that you will print it in Club Corner.

We count more than 600 members, and there is little doubt that we are the largest club in Norway. Our address is;

Norway ZX User Group
Box 874
3001 DRAMMEN
Tel: (03)-82 15 22

Sinclub

Dear ZX Computing,
We have opened a Sinclair club in Israel. The club will be for the users of the Spectrum, Spectrum plus and QL. The subscription is about $9 (10,000 shekels) per half a year. It includes a monthly newsletter which will be sent by mail to the members and much, much more.

The newletter we have in mind will include a TOP 30 chart, an INPUT/OUTPUT section where members can advertise for selling/buying/exchanging hardware, software and whatever, hints and tips on programming, reviews on the latest software (and hardware) hints on transferring programs to microdrive (on Spectrum, on QL all programs are on microdrive anyway) and anything else you could possibly think of.

Any help with the organization or any ideas will be welcome. Overseas (outside Israel) members also welcome though the magazine is in Hebrew. Waiting to hear from you!!!

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Tel. 01/241 19 08 oder
Tel. 01/948 00 25

CH-8627 Grüningen

S.A. Correspondence

Dear ZX Computing,
I am a regular reader of your magazine and have bought every copy since the day I started learning programming on my Spectrum, three years ago. Keep up the good work.

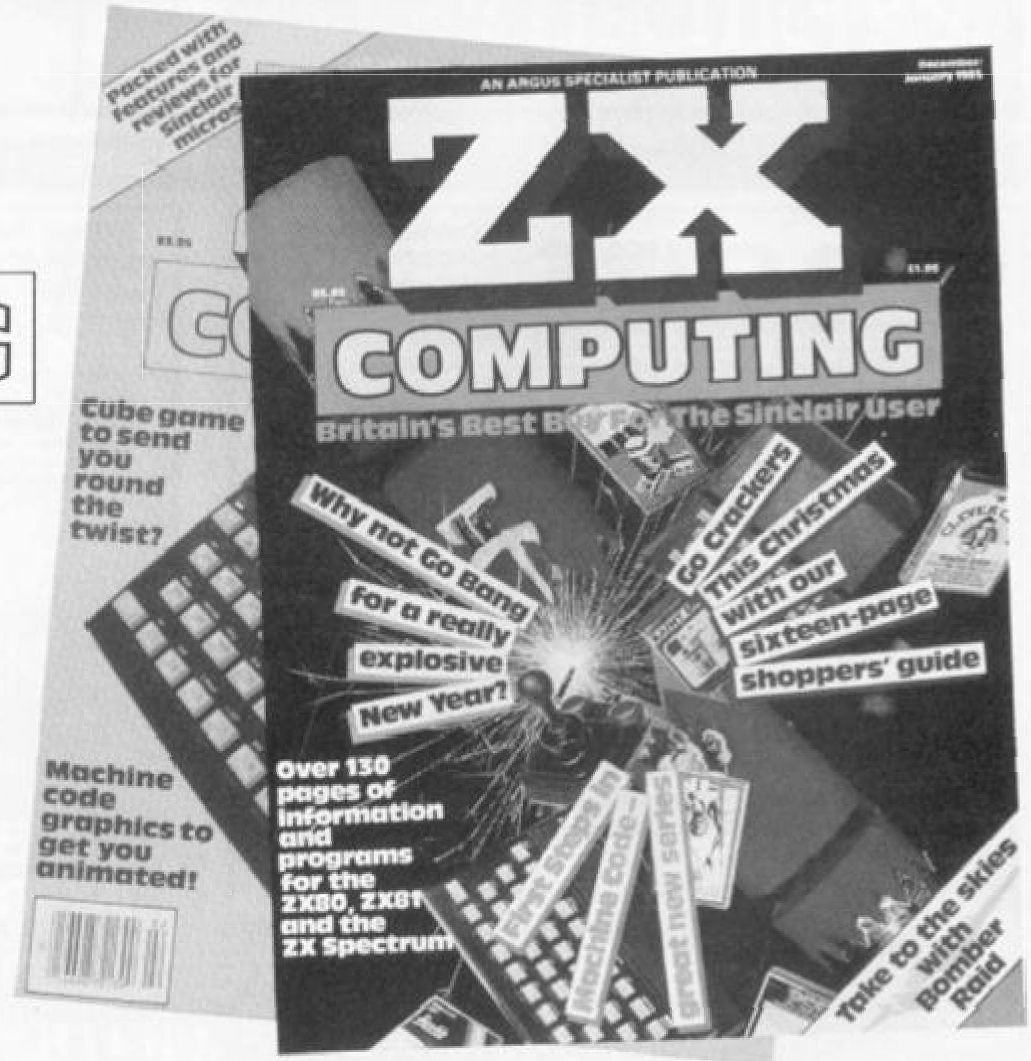
I wish to correspond with anyone through the post, and to exchange ideas and programs and would be grateful if anyone wishing to do so would please write to me at the address below.

In case anyone wishes to know, I also own a Seikosha GP 250X printer, Interface 1 with two microdrives, Interface 2 with two joysticks, Currah Speech module, VTX5000 modem, and Centronics interface and monitor.

Yours sincerely,
M.P. de Bruyn
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Park Town
2193
Johannesburg
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